Climate Change and Livelihoods in Northwest Bangladesh:

Vulnerability and Adaptation among Extremely Poor People

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SUMMARY:

This research contributes to the development of pro-poor approaches to climate change adaptation through empirical exploration of the nature of climate change vulnerability among extremely poor communities in rural Bangladesh.

Poverty and climate change vulnerability are widely regarded as being closely linked, however this is based on a fairly generic understanding of vulnerability and adaptive capacity. There remains a scarcity of empirically grounded work on how climate related impacts affect livelihoods across and within groups of poor people on the ground. In particular, there is a lack of disaggregated research around the factors and processes that shape differentiated levels of climate change vulnerability—and thus differentiated adaptation needs—across and within extremely poor communities and households.

A Mediating Factors Framework has been developed to guide data collection and analysis; it integrates concepts and fieldwork methodologies from livelihoods and poverty fields with those from the pro-poor climate change literature. The Framework explores both climate related vulnerability and elements that comprise or influence levels of adaptive capacity among extremely poor respondents.

Findings suggest that climate-related vulnerability is differentiated at the sub-community level, mainly between different livelihood and social groups, however areas of commonality also emerge. A combination of tangible and intangible resources, factors, and processes underpin and mediate these patterns of differentiation and commonality, and influence levels of response to climate related impacts. While there appears to be little activity that could be termed ‘adaptation’ currently occurring in either field site, data suggest that addressing underlying drivers of vulnerability is central for supporting adaptive capacity among extremely poor communities. In addition, investment in human resources, i.e. health, education, and skills training, are critical for adaptation through, for instance, supporting flexibility in terms of accessing less climate sensitive income-earning opportunities in the local area, and migrating to more sustainable areas.

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List of Acronyms

AR4	Fourth Assessment Report, IPCC
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advanced Studies
BMD	Bangladesh Meteorological Department
CCC	Climate Change Cell, Ministry of Environment and Forests, Bangladesh
CGIAR	Consultative Group on International Agricultural Research
CLP	*Chars* Livelihood Programme (DFID)
CVCA	Climate Vulnerability and Capacity Analysis
DFID	Department for International Development, United Kingdom
DoE	Department of Environment, Bangladesh
FAO	Food and Agriculture Organization
FGD	Focus group discussion
GUK	Gana Unnayan Kendra
HIES	Household Income and Expenditure Survey, Bangladesh
HYV	High yielding variety
IDS	Institute of Development Studies
IFPRI	International Food Policy Research Institute
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
MoEF	Ministry of Environment and Forest, Bangladesh
MoFDM	Ministry of Food and Disaster Management, Bangladesh
MWR	Ministry of Water Resources, Bangladesh
NAPA	National Adaptation Plan of Action
NARS	National Agricultural Research System, Bangladesh
NGO	Non-governmental organization
OAP	Old Age Pension
PRA	Participatory rural appraisal
PRSP	Poverty Reduction Strategy Papers
RDRS	Rangpur Dinajpur Rural Service
RRA	Rapid Rural Appraisal
SSNs	Social Safety Nets
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WFP	World Food Programme
VGD	Vulnerable Group Development Programme
VGF	Vulnerable Group Feeding Programme

Glossary

Adi	Sharecrop
Akal	Local word for food insecurity in field sites
Allah	Arabic/Bengali word for God
Aman	Wet season paddy
Aus	Paddy grown in late dry season/early monsoon
Bandhak	Land rental arrangement in which cultivator gives landowner sum of money that is returned after period of cultivation ends
Bogoban	Hindu word for God
Boro	Dry season paddy
Borgha	Land rental where payment is made for set time of land use
Bigha	A unit of land measurement equivalent to 20 *katha,* 33 decimals, or .2 acres
Char	Coastal or riverine island formed by cycles of erosion and accretion of sediment
Chena	A grain that is mixed and eaten with rice
Dhar koroj	Community safety net, also known as *hawlat*
Dena	Borrow money on interest
Din mojur	Day labour
Dakkhin	South
Dhuncha	A local crop similar to jute
Dabar	Heavy rainfall/storms
Gorib	Poor
Ghurnijhar	Cyclone, also known as *tufan*
Hurka	Strong wind
Imam	Leader of congregational prayers in the mosque
Jama't	Local Muslim congregation
Kathay	Tool used by agricultural day labourers to harvest paddy
Khas land	Government-owned land
Kom gorib	Extremely poor
Lakh	A word commonly used in South Asia to mean 100,000
Mattabor	Locally powerful man, usually rich and widely respected
Modhom	Middle
Moharam group	A religious group that comes together temporarily before Muslim holidays to organize events
Monga	Acute seasonal hunger related to lack of work between planting and harvesting seasons of major crops
Mouza	Village

Obosta	Life condition
Ovab	Local word for lack of work in field sites
Para	A neighbourhood, or hamlet
Poli	Fertile, nutrient-rich mud
Poschim	West
Puja	Similar to *Moharam* group but for Hindus
Sahajjo	Help
Sami ney	No husband/widow
Shon	A crop similar to jutestick
Taka	National currency of Bangladesh
Theka	Deprivation/struggle
Upazila	Administrative unit below Sub-Division, also known as *Thana*
Uttor	North
Vikkuk	Beggar

Chapter 1:
Overview of research

In the past five years, global scientific assessments have concluded with high levels of certainty that climate change is already occurring, partly driven by anthropogenic interference with the climate system, and that important impacts are unavoidable over coming decades (Bernstein et al., 2007). Moreover, these climate change impacts will disproportionately affect poorer regions of the world, whose populations are both collectively least responsible for contributing to rising emissions levels and least able to deal with the associated consequences (Adger et al., 2006; Smit et al., 2001). Poor people (1) live in geographically more exposed and marginal regions; (2) their livelihoods depend on natural resources that are more sensitive to changes and variability in climate and extreme weather events; and (3) they possess limited resources to mobilize towards coping with present impacts or investing in longer-term adaptation (Adger et al., 2003; CCCD, 2009). Bangladesh, one of the poorest and most vulnerable countries to the impacts associated with climate variability and change, is a striking example of these issues (Agrawala et al., 2003; Tanner et al., 2007; World Bank, 2000; MoEF, 2005, 2009, 2012; CCC, 2009a).

As a result of the factors listed above, poverty and vulnerability to climate change are widely regarded as being closely linked (Pettengell, 2010; Scott, 2008; Skoufias et al., 2011), although this is still based largely on a fairly generic understanding of vulnerability and adaptive capacity. There remains a scarcity of empirically grounded work on the dynamics of vulnerability, coping, and adaptive capacity across and within groups of poor people on the ground (Tanner and Mitchell, 2008). In particular, extremely poor communities are being missed; the empirical work on vulnerability and adaptation that has emerged over recent years focuses mainly on poor farmers. The livelihoods of extremely poor people depend on similar climate-sensitive resources to those of poor farmers, but in importantly distinct ways; however this has been the subject of relatively less climate change research to date. This represents a critical gap, given that Africa and South Asia, two regions with the highest concentrations of chronic poverty, are also likely to experience the most severe impacts from climate change (Scott, 2008). Impacts from climate change threaten to add additional challenges to addressing extreme poverty, while potentially increasing the size of this demographic by entrenching poor and vulnerable people further into poverty in the future. Furthermore, despite an increase in international funding for climate change adaptation, resources are still insufficient to support planned adaptation programmes on a scale commensurate with needs. Therefore, many have

begun to hypothesize about the role that autonomous adaptation by individuals, households, and communities may play, but there is a relative scarcity of research on the feasibility and implications of this for extremely poor communities in settings where they are already being missed by on-going development programmes and safety nets (Malik et al., 2010; Schneider et al., 2001; Fankhauser et al., 1999).

This research therefore provides an empirically grounded analysis of the vulnerability context among extremely poor people in rural Bangladesh; their perceptions with respect to their own vulnerability, and the risks that climate-related impacts pose to their livelihoods; their knowledge and experience in coping with climate shocks and stresses; and the mediating factors that influence their coping and adaptive capacity. A particular aim has been to explore the factors and processes that shape *differentiated* levels of climate change vulnerability—and thus differentiated coping and adaptation needs—across and within extremely poor communities and households. A better understanding of nuances across groups and individuals, and particularly among those defined as the 'most vulnerable', extremely poor rural households, is critical for assessing how to target scarce domestic and international funds where they will be most effective in supporting the capacity to respond to climate-related impacts in the present and future by extremely poor people; how to adjust on-going poverty and vulnerability interventions (e.g. asset transfer programmes and social protection) to better reach extremely poor people where they are being missed and to address climate-generated needs of beneficiaries; and, more broadly, for understanding how climate change and development should be framed with respect to one another.

Bangladesh was selected as the general location for fieldwork for several reasons. First, despite impressive advances over the last decade, it remains a low-income country with a significant number of rural households living in extreme poverty and is also recognized to be one of the countries most vulnerable to climate change. Second, Bangladesh has an exceptionally strong set of think tanks, non-governmental organizations (NGOs), and local researchers who have focused on climate change issues, in close partnership with the government, and hence there was interest in the results of the research. Fieldwork was supported at the national level by the Bangladesh Centre for Advanced Studies (BCAS), in collaboration with the Institute of Development Studies (IDS), and at the local level by Gana Unnayan Kendra (GUK), a Gaibandha-based partner of BCAS.

The two main field sites selected for this research are in Gaibandha District, in Northwest Bangladesh. These sites include both a river embankment and a riverine *char*[1] island, that are among the poorest and most disaster-prone and climate vulnerable areas in Gaibandha. Their

[1] Riverine islands created by the process of erosion and accretion of alluvial soils (CCC, 2009a).

location at the confluence of the Jamuna and Teesta rivers makes them particularly vulnerable to alternating floods and drought, and riverbank erosion, all of which severely constrain livelihoods. Both sites are characterized by high rates of extreme poverty and food insecurity; high reliance on agriculture and, in particular, agricultural day labour; high vulnerability to natural hazards; poor performance across basic human development indicators; and low access to government services and non-governmental organization (NGO) development programmes, relative to both the rest of the country and to other *upazilas* (sub-districts) in Gaibandha. It was with the cooperation of these communities that fieldwork took place between November of 2009 and September of 2010.

The central questions that guided the research were: *What is the nature of vulnerability to climate change impacts among extremely poor households and individuals in the fieldwork areas? What are local perceptions among extremely poor people about climate and non-climate related risks, and livelihood coping and adaptation needs and constraints?* In particular, how are climate shocks and stresses affecting the various social and livelihoods groups that make up 'the extreme poor'? How do climate-related shocks and stresses fit within the wider risk and vulnerability context? What are local perceptions of climate change, and what indigenous autonomous, and intervention-based coping and adaptation activities are already taking place, if any, at the community and household levels? Where do gaps and needs exist with respect to future adaptation?

Main hypotheses: *(1) Climate change is altering the pre-existing vulnerability context for extremely poor people in the field site areas. (2) Climate change vulnerability is differentiated among extremely poor individuals and households. (3) Several 'mediating factors' affect this differentiation and influence local coping and adaptive responses.* Communities perceive changes in climate, including increased variability of extreme events and shifting weather patterns, on the ground in Bangladesh. These changes may be affecting the wider context of multiple stressors in which extremely poor communities confront the effects of shocks and stresses, climate-related or otherwise, and thus are affecting local livelihoods in wide ranging albeit undocumented ways, that may be differentiated. The extreme poor are heterogeneous, may experience climate impacts in different ways, respond differently to them, and may therefore have different needs with respect to climate change adaptation.

The Mediating Factors Framework has been developed to guide data collection and analysis, and integrates concepts and fieldwork methodologies from livelihoods and poverty fields with those from the pro-poor climate change literature. The Framework explores both climate related vulnerability and elements that comprise or influence levels of adaptive capacity among extremely poor respondents. The methodological approach has been participatory, with an

overarching aim to explore climate change vulnerability: (1) from the perspective of local people characterised as 'most vulnerable' to the impacts of climate change; (2) at a disaggregated level to explore differences across and within households and community; and (3) as a dynamic process.

The organization of the thesis is as follows.

Chapter 2 reviews three relevant bodies of literature for the thesis, and the conceptual approach. This covers literature on: (1) knowledge of global climate change and associated secondary impacts; (2) approaches to framing and analysis of vulnerability; and (3) evolving approaches to climate change adaptation, with particular focus on emerging pro-poor perspectives. The conceptual approach builds on the livelihoods framework as a guide, integrating the additional concepts of *resources* (rather than capitals) and *mediating factors*, i.e. the factors and processes that influence levels of climate related vulnerability, coping, and adaptive response and capacity among respondents into a Mediating Factors Framework. This process was guided by the qualitative research design of the thesis and ethnographic approach to methodology.

Chapter 3 introduces the methodological approach undertaken in this research. This includes a review of the main fieldwork questions and hypotheses, as well as an overview of the three main phases of fieldwork, each corresponding to progressively smaller units of analysis. These include: (1) Climate Vulnerability and Capacity Analysis (CVCA), comprised of village-level, climate-focused Participatory Rural Appraisal (PRA) activities conducted through a range of focus group discussions (FGDs); (2) household level interviews; and (3) life history interviews with individual respondents.

Chapter 4 introduces the country context of Bangladesh, at both the national and sub-national (regional, district, *upazila*, and union) levels, including relevant demographic, geographic, and socio-economic data on trends in growth, structural transformation, development, and poverty reduction. It then presents data on past climate trends and the state of knowledge on likely future climate trends of relevance to this research, and analyses potential implications for extremely poor rural communities in the fieldwork area.

Chapter 5 draws on primary data from all three phases of fieldwork (CVCA, household interviews, and life history interviews) to present: (1) a picture of life in the two fieldwork sites; (2) the different wealth groups identified through participatory community wealth ranking exercises; and (3) the nature of livelihoods of the core, extremely poor respondent groups in the two field sites, including their main livelihood activities, with particular attention to climate sensitivity, seasonality, and diversification.

Chapter 6 analyses respondents' perceptions of whether, and in what ways, climate has changed over recent years, including both shifting weather conditions and patterns (temperature, rainfall, and drought) and extreme events (flooding, storms, and erosion). It explores how these have affected livelihoods of extremely poor community members in the two fieldwork sites, and their perceptions about the climate and non-climate related hazards that they feel pose the greatest risks to their livelihoods now and in future. The purpose is to analyses climate related shocks and stresses within the wider context of multiple and inter-related stressors that characterise the lives of extremely poor respondents.

Chapter 7 analyses the coping and adaptive activities undertaken by respondents in planning for and responding to the livelihood impacts of climate related hazards, and the factors and processes that mediate these various activities. It explores the potential barriers and opportunities around coping and adaptation, through analysis of the role of "mediating factors" in shaping differential vulnerability across respondent households and individuals. Findings suggests that a mix of tangible and intangible factors and processes influences both vulnerability and the nature of response to climate-related impacts over different timescales. The mediating factors that emerge as especially instrumental in the fieldwork sites include: physical capability and health; community and family networks; political ties and corruption; information about climate and weather; and perceptions of climate change and beliefs about the causes. The ways in which these operate at individual, household, and community levels is drawn out, and reflections are made on how these mediating factors correspond to elements of vulnerability and/or potential indicators of adaptive capacity for respondents.

Chapter 8 summarizes main findings of this research, including: (1) vulnerability is differentiated across the respondent group, however patterns of commonality also exist. (2) There appears to be little activity that could be termed 'adaptation' currently occurring in either field site. Much of the response activity currently undertaken to address impacts from climate-related shocks and stresses is short-term coping. (3) Several mediating factors influence vulnerability and coping across respondents; these affect both access to resources (e.g. secure housing, jobs, and healthcare) and the "motivational context" (Haddad, 2005) for adaptation (e.g. beliefs and perceptions about climate change, and information). This chapter concludes by drawing implications of these findings for research and design of interventions around climate change vulnerability, adaptation, and adaptive capacity among extremely poor people.

Chapter 2:
Literature review and conceptual framework

2.1. Introduction

This chapter reviews relevant bodies of literature for this thesis, beginning in Section 2.2 with an overview of the state of scientific knowledge on global climate change, including observed and expected future climatic changes, associated secondary impacts, and implications for development and poverty reduction in poor countries. Section 2.3 introduces vulnerability and adaptation, briefly tracing the evolution of approaches to research around these concepts in the climate change field, before Section 2.4 reviews the vulnerability concept. This begins with an overview of the wide ranging theoretical perspectives on vulnerability across development and poverty fields, on the one hand, and ecology traditions, on the other, before exploring how these approaches have contributed to development of "starting point" and "end point" (O'Brien et al., 2007) modes for conceptualizing climate change vulnerability. Section 2.5 reviews the literature on adaptation to climate change, beginning with an overview of main approaches to theorising and categorising adaptation. This section then introduces pro-poor perspectives on adaptation, highlighting certain emerging areas of research in the climate change field that are of particular relevance to this thesis, including: the role of indigenous knowledge and perceptions of climate change, adaptive capacity perspectives, and sustainable adaptation.

Section 2.6 concludes the literature review by outlining the main gaps that exist in the knowledge base on climate change vulnerability and adaptation, including empirical evidence on: (1) the nature of vulnerability, adaptation, and adaptive capacity among extremely poor people; (2) differentiation at the sub-community level, across and between households and individuals that comprise 'the extreme poor'; and (3) analysis of the intangible factors and processes that underpin differential vulnerability and adaptation for this group.

The remainder of this chapter (Section 2.7 onward) lays out the conceptual approach of this thesis. The livelihoods framework is used as a guide to exploring vulnerability, which is approached from a "starting point" perspective, as the context in which extremely poor people experience, cope with, and adapt to the effects of climate-related shocks and stresses. Since a broad purpose of exploring vulnerability is to also understand potential ways to support the development of adaptive capacity among extremely poor people, elements of frameworks for exploring both are included in this conceptual approach. Towards this end, a Mediating Factors

Framework has been developed to guide data collection and analysis, integrating the concepts of *resources* and *mediating factors*, i.e. the factors and processes that influence levels of climate-related vulnerability *and* adaptive capacity (or areas of potential support for building adaptive capacity) among extremely poor respondents.

2.2. Global climate change[2]

2.2.1. Observed climate change

Global mean annual temperatures rose by about half a degree Celsius over the 20th century, with the rate of warming over the last 50 years (i.e. 1956-2003) approximately doubling that observed over the last 100 years (i.e. 1906-2005) (Trenberth et al., 2007). The greatest temperature increases have occurred at higher northern latitudes, i.e. in the Arctic, where temperatures have increased at almost twice the global average rate over the past 100 years (Bernstein et al., 2007). Approximately 80 per cent of the heat added to the climate system has been absorbed by the global ocean, and compounded by melting of ice caps and glaciers this has led to a total rise in sea level over the course of the 20th century estimated at 0.17m. Long-term precipitation trends (1900-2005) have also changed, with significant increases in eastern parts of North and South America, northern Europe, and northern and central Asia and declining rainfall in the Sahel, Mediterranean, southern Africa, and parts of southern Asia; globally, the area affected by drought has likely increased since the 1970s (ibid.).

Changes in temperature and precipitation have, in turn, led to shifts "in the frequency, intensity, spatial extent, duration and timing of extreme weather and climate events" (Allen et al., 2012: 5, 6-7). The Intergovernmental Panel on Climate Change released a Special Report on Extreme Events and Disasters (Field et al., 2012) that states that some climate extremes[3] have changed over the last 50 years, reflecting the influence of both natural climate variability and anthropogenic climate change. These observed changes include: an increase in the number of warm days and nights (very likely)[4] and a warming trend in daily temperature extremes in much

[2] The Intergovernmental Panel on Climate Change (IPCC) defines climate change as "a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer" (Bernstein et al., 2007: 30). This definition includes any change in climate, whether a result of natural variability or of human activity. Climate variability refers to shorter-term variations in the climate system (Parry et al., 2007b).

[3] Refers to extreme weather and climate events, i.e. "the occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of the variable" (Allen et al., 2012: 3).

[4] Various approaches are used in the IPCC Assessment Reports to describe and characterize uncertainty levels. Likelihood statements (e.g. *very likely, likely, unlikely*) are used when uncertainty around specific

of Asia (medium confidence);[5] likely increase in the number of heavy precipitation events in some regions; increases in tropical cyclone activity (low confidence) and likely pole ward shift in the main Northern and Southern Hemisphere extra-tropical storm tracks; longer and more intense droughts in some regions, such as Europe and West Africa, and less frequent and intense and shorter droughts in other regions, like central North America and north western Australia (medium confidence); likely increases in extreme coastal high water related to increases in sea level; and some changes in the magnitude and frequency of flooding at the global scale—however limited evidence around the climate-driven observed changes in flooding affords this observation low confidence (Allen et al., 2012: 6, 7).

Impacts associated with these changes are affecting human societies around the world, in myriad direct and indirect ways, and to varying degrees across countries and communities. In poor regions and countries climate change has already begun to constrain economic growth, development, and poverty reduction, largely through impacts from changes in both average conditions (e.g. temperature) and climate extremes (e.g. increasingly intense droughts and precipitation) on sectors like agriculture (including forestry and fishing), industry, water resources, coastal zones, and human health (Mitchell et al., 2012; Rosenzweig et al., 2007; Adger et al., 2007). For poor communities on the ground, these impacts engender "increasing variability and uncertainty of the conditions in which people try to pursue their livelihoods" (Cannon and Mueller-Mahn, 2010: 621).

More specifically, warming has constrained crop yields and agricultural productivity in dry and low latitude regions, in turn, affecting food security and nutrition at the national level as well as the livelihoods of poor communities through rising food prices, reduced employment, and lower productivity of natural resources and ecosystems (Easterling et al., 2007). The quality and reliability of water resources, including potable drinking water, has decreased, particularly in arid and semi-arid regions, compounded by an increasing risk of droughts and flooding across many regions (Kundzewicz et al., 2007). Human health has also been affected, for instance changes in temperature have led to shifts in the distribution of infectious disease vectors, including malaria, dengue, and cholera (Confalonieri et al., 2007). Increasingly frequent and severe climate extremes have led to great loss of life and injury, as well as loss of resources and

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outcomes is assessed using expert judgement and statistical analysis of a body of evidence (Bernstein et al., 2007: 27).

[5] Confidence levels are used to convey assessed chance of a finding being correct, based on expert judgement of the correctness of underlying data, models or analyses. The following scale is used: *very high confidence* at least 9 out of 10; *high confidence* about 8 out of 10; *medium confidence* about 5 out of 10; *low confidence* about 2 out of 10; and *very low confidence* less than 1 out of 10 (Bernstein et al., 2007: 27).

damage to housing, infrastructure, and industrial activities. Resulting in large part from increasing exposure of human populations and economic assets to climate extremes, there has been a long-term increasing trend in economic losses from climate-related disasters over recent decades (Handmer et al., 2012). In absolute terms, GDP losses from disasters have been greater in developed countries; however fatality rates, and economic losses expressed as a share of GDP, have been significantly higher in developing countries (Allen et al., 2012).

2.2.2. Future climate change

Depending on which scenario of socio-economic development is assumed in modelling future conditions (Nakicenovic et al., 2000), projections suggest that global temperatures will continue to rise somewhere between 1.8° and 4.0°C by the end of the 21st century (Bernstein et al., 2007: 13). These estimates are based on the most recent IPCC Assessment Report (2007); however indicators are already reflecting near the worst-case projections from the model simulations presented in this report (Allison et al., 2009). More recent estimates project more rapid and drastic warming than did those of the IPCC, suggesting that the 6.4° C increase indicated at the high range of the IPCC's high scenario (A1FI) may be closer to accurate. For instance, the Hadley Centre projects warming by 2° C as soon as 2045-60 (Betts et al., 2011), and Allison and colleagues (2009: 51) predict warming between 2° and 7° C above pre-industrial levels by 2100. Avoiding warming above 2° C is a widely supported policy goal, based on science identifying this amount of warming as a threshold beyond which certain large ecosystems are likely to reach critical tipping points, leading to "abrupt and irreversible change" in environmental systems and societies (ibid.: 42).

While a strong scientific consensus exists that the global climate system will continue to warm under various emissions scenarios, understanding of the rate and magnitude of changes in temperature and precipitation, and secondary impacts of these across different regions, is less advanced (Meehl et al., 2007; Rosenzweig et al., 2007; Field et al., 2012). In relation to climate extremes in the future: hot extremes in temperature and warm spells are 'virtually certain' to increase in frequency; heavy precipitation is 'likely' to increase and in some places "heavy precipitation may increase even if total precipitation decreases" (medium confidence) (Allen et al., 2012: 11). Regionally, precipitation overall is 'very likely' to increase in high latitudes and 'likely' to decrease further in most subtropical regions (Bernstein et al., 2007: 46). Increasing trends in extreme coastal high waters are 'very likely' (Allen et al., 2012), and "by 2100, global sea level is likely to rise at least twice as much as projected by Working Group 1 of the IPCC Fourth Assessment Report; for unmitigated emissions it may well exceed 1m. The upper limit has been estimated at ~ 2 m sea level rise by 2100" (Allison et al., 2009: 9). Maximum wind

speed of tropical cyclones is likely to increase, although not in all ocean basins; globally, there is likely to be no change or a decrease in the frequency of tropical cyclones and extra-tropical storms (medium confidence), although regional patterns of projected change are less certain (Allen et al., 2012: 11). Changes in temperature and precipitation may lead to shifts in the frequency and magnitude of flooding in some regions, for instance heavy rainfall possibly leading to increased flooding in some catchment areas (medium confidence). In some areas, and during certain seasons, droughts may intensify in the future (medium confidence) (ibid.: 11).

These processes are likely to impact upon physical, biological, and human systems and sectors in various ways, with differential effects across countries and people with respect to: ecosystems and loss of biodiversity; agricultural production and food security; human settlements and industry; availability of water resources; and human health (Parry et al., 2007a). Nationally, impacts from climate change threaten to constrain GDP growth and achievement of development targets in poor countries, for example the Millennium Development Goals (MGDs) (Stern, 2006, 2009; UNDP, 2007). For local communities on the ground, many of these impacts may reinforce and perpetuate poverty (Pettengell, 2010; Khan et al., 2010).

In light of these challenges, great interest has developed around assessing vulnerability of human and natural systems to the impacts associated with climate variability and change. Much of this work has been done towards the end of defining and designing adaptation to current and future impacts, and generating a greater understanding of how to enhance the capacity of communities on the ground to adapt to changing conditions over different timescales. These approaches are reviewed in the following sub-sections.

2.3. Evolution of research on climate change vulnerability and adaptation

Approaches to research on climate change vulnerability and adaptation have evolved considerably over recent decades. So-called ‘first generation’ approaches (Burton et al., 2002; Fussel and Klein, 2002; Huq and Toulmin, 2006; McCarthy et al., 2001) focus on modelling future climate change impacts based on emissions scenarios. This is referred to as the *impacts-led* approach, as vulnerability is defined in relation to potential damage or loss incurred by a system from a climate hazard, with an ultimate aim of identifying costs and benefits of different adaptation options. This approach stems from notions of climate change as an environmental issue, with solutions often comprising technological (development of more climate-resilient crop varieties) and infrastructural (construction of embankments) interventions. This approach does not consider climate-related impacts in the present or the influence of extra-climatic (i.e.

socio-economic and political) factors, such as the inequities that "contribute to differential capacities to adapt" (Eakin and Patt, 2011: 142) across human populations over different timescales.

The "second generation" of climate change research is characterised by a rise in prominence of an *impacts* and *vulnerability-led* approach (Burton et al., 2002). This shift came about as a result of increased evidence of the severity of impacts from climate-related disasters on the lives and livelihoods of poor people in the present, and the threats this poses to achievement of development and poverty reduction objectives in low-income countries (ADB et al., 2003). While climate change science was becoming more precise, the uncertainty involved in projecting impacts from future changes led to an increased focus on adaptive capacity, specifically the factors that influence people's abilities to adapt to impacts from climate variability and change over different time scales (Eakin and Patt, 2011). With this, climate change became re-cast as an issue of central concern to the development community, with calls to address impacts and vulnerability in the present as the necessary starting point for building capacity to adapt to future impacts (O'Brien et al., 2004; DFID, 2006; Tanner and Mitchell, 2008; Fussel and Klein, 2002).

Second generation climate change research has been characterized by a broadening of coverage, to include consideration of the factors and processes shaping the wider context in which climate-related impacts occur. From this perspective, vulnerability is defined as a state, or "set of attributes generated by social and environmental processes, including climate change, which limit the ability to cope with climatic and other stress" (Adger et al., 2006: 5; Allen, 2003). These attributes are underpinned by various socio-economic, political, and structural factors that shape differential capacities to respond to climate-related impacts across and within communities, as well as exposure and sensitivity to impacts (Fussel and Klein, 2002). Studies undertaken from this approach would highlight the context of multiple stressors in which poor people experience impacts from climate change (Eriksen et al., 2008; O'Brien et al., 2004); and the fact that while they have less to lose in absolute terms from shocks like flooding in Bangladesh, relative to annual income, the loss is in fact much greater than for wealthier households (e.g. Brouwer et al., 2007: 321).

Within this tradition, climate change researchers have been engaging with social science and development research themes, for example: poverty/chronic poverty (Eriksen et al., 2007; Ulsrud et al., 2008; Tanner and Mitchell, 2008; Scott, 2008), livelihoods/asset based approaches (Pouliotte et al., 2009; IUCN et al., 2003; Sabates-Wheeler et al., 2008; Prowse and Scott, 2008; Moser and Satterthwaite, 2008); social protection (Davies et al., 2008; Arnall et al., 2010;

Heltberg et al., 2008; CCCD, 2009); climate justice and human rights (ICHRP, 2008; Polack, 2008; Annan, 2007). A common feature among these approaches is a call for increased empirical data on social aspects of climate change—i.e. how climate impacts play out across vulnerable communities in affected countries.

The concept of social ecological resilience has become central in climate change research over the last decade, with a particular focus on links between resilience, adaptation, and adaptive capacity (Eakin and Patt, 2011; Folke, 2006; Gallopin, 2006; Bahadur et al., 2010). The resilience concept emerged initially from ecology approaches to exploring social ecological systems (SES). According to Carpenter et al., (2001) (cited in Folke, 2006: 259-260), resilience is comprised of "(1) the amount of disturbance a system can absorb and still remain within the same state or domain of attraction; (2) the degree to which a system is capable of self-organization (versus lack of organization, or organization forced by external factors); and (3) the degree to which a system can build and increase the capacity for learning and adaptation."

Most work on resilience focuses on the first part of this definition, the capacity to absorb shocks and resist change. However, emerging insights in ecology, and in relation to climate change specifically, suggest that resilience is perhaps more about the "capacity for renewal, re-organization and development" (Folke, 2006: 253; Holling and Gunderson, 2002: Berkes et al., 2003; Ensor, 2011; Jordan, 2011). The opportunities that external shocks and disturbances present for "recombination of evolved structures and processes, renewal of the system and emergence of new trajectories" (Folke, 2006: 259), as may be the case with climate change-induced switching to new modes of operation—or alternative livelihoods systems—represent a shift to a new state of being and doing that is better suited to thrive and survive in the local environment and context.

The approaches reviewed above reflect not only an evolution of research but also alternative framings of the climate change issue, particularly between a scientific discourse, which remains dominant in the international climate change regime and policy processes (e.g. United Nations Framework Convention on Climate Change (UNFCCC), IPCC) (O'Brien et al., 2007), and a social science and human security approach, which has more recently emerged in the research around development and poverty-oriented perspectives on climate change. These alternative framings of climate change, in turn, are characterised by different methodological approaches to analysing vulnerability, and ultimately diverge in the kinds of adaptation interventions that are highlighted (ibid.).

The sections that follow review: (1) approaches to vulnerability from within the development and poverty literature, and in hazards and ecology traditions, as these have fed into development

of the vulnerability concept within the climate change field (Section 2.4); and (2) approaches to climate change adaptation (Section 2.5).

2.4. Approaches to vulnerability

A wide range of literatures from various fields offers models for theorising vulnerability and mapping its components on the ground. The approaches that have most directly fed into development of the concept of climate change vulnerability stem broadly from natural hazards, poverty, and development fields (Brooks, 2003; O'Brien et al., 2007). The range of perspectives from these fields provide valuable insights, for instance on the relationship between natural hazards and human vulnerability; disaggregated, differentiated views of poverty and vulnerability; and methods for observing and measuring vulnerability on the ground.

Across most disciplinary approaches, vulnerability is defined with reference to the future, as the *potential* of experiencing harm (Moser, 1998; Prowse, 2003; Alwang et al., 2001), and is often considered a function of the exposure of a system (e.g. social, ecological) to a hazard or risk, its sensitivity, and ability to respond, i.e. its resilience or adaptive capacity. These different elements of vulnerability have different terms and are differentially emphasized across diverse fields and approaches (Smit and Wandel, 2006).

2.4.1. Natural hazards and development perspectives on vulnerability

Approaches to analysing vulnerability can be broadly divided between those that conceive of vulnerability in terms of risk, and those that focus instead on vulnerability as a context in which multiple factors and processes interact to constrain activity and options of some people. More specifically, differences can be mapped in terms of where focus is placed among: (1) *risk events*, for example natural hazards (Jones and Boer, 2003; UNDHA, 1992; Sarewitz et al., 2003), economics and social risk management (Burton and van Aalst, 2004; Heltberg et al., 2008; Alwang et al., 2001; Dercon, 2002), and approaches to managing risk, and outcomes in relation to some defined threshold, such as a poverty line; (2) *the context* in which risks and shocks occur, i.e. the vulnerability context, and "structural factors that make human societies... susceptible to damage" (Brooks, 2003: 4), including social vulnerability (Adger, 1999; Kelly and Adger, 2000; Allen, 2003; Blaikie et al., 1994), entitlements (Sen, 1981), and political ecology (Forsyth, 2003; Robbins, 2004; Oliver-Smith, 2004); or (3) *the role of actors*, agency, and culture in shaping the social construction of vulnerability, i.e. constructivist and anthropological approaches (i.e. McLaughlin and Dietz, 2008; Oliver-Smith and Hoffmann, 2002).

In the natural hazards and ecology literatures, vulnerability has been conceived specifically in relation to the potential damage incurred by a system from a specific hazard. The SES concept has become central in climate change research, and "reflects the idea that human action and social structures are integral to nature and hence any distinction between social and natural systems is arbitrary" (Niamir-Fuller, 1998: 269). A resilient system is capable of retaining its central structures and functions through disturbances, while "still maintaining options to develop" (Eakin and Patt, 2011: 143; Nelson et al., 2007). These approaches highlight a system's ability to encounter and respond to impacts of climate change, the nature of which are uncertain, therefore underscoring the importance of building resilience to respond to change more broadly (Eakin and Patt, 2011; Ensor, 2011).

Poverty and livelihoods literature conceives of vulnerability as a state determined by socio-economic and political factors and processes that exists prior to the occurrence of a hazard, and mediates exposure and sensitivity to it, as well as the ability of individuals and communities to cope with its effects. Vulnerability from this perspective is contingent on factors like inequality and access to resources (Blaikie et al., 1994; Paavola and Adger, 2006; Dercon, 2005; Reid and Vogel, 2006; Tschakert, 2007), which, in turn, are seen as a function of the "social realm of institutions, well-being... class, social status and gender" (Adger, 2006: 271). Vulnerability is often conceived in relation to the effect of a shock or stress on the "poverty status of a household relative to some welfare measure such as a poverty line" (Sabates-Wheeler et al., 2010: 103), or in terms of the potential of becoming food insecure (Swift, 1989); falling into poverty, malnutrition, or poor health (Pryer, 1989; Corbett, 1989).

Increasingly, empirical evidence is linking vulnerability and risk to persistent poverty, or 'poverty traps' (McPeak and Barrett, 2001; Carter and Barrett, 2005) in developing country contexts, highlighting the fact that even temporary shocks may have permanent consequences. This link operates in two ways: firstly through erosion of assets that commonly results from shocks and stresses, or from the coping strategies undertaken to address them, and also from the risk management strategies undertaken by poor households, many of which result in avoidance of high risk but high return income-earning opportunities (Sabates-Wheeler et al., 2010; Dercon, 2005, 2010; Barrientos, 2007; Hoddinot, 2006). Vulnerability has often been thought of as a dynamic concept, while poverty is more static, although increasing recognition of poverty as a multi-dimensional and dynamic condition has made this distinction less important (Prowse, 2003). The emphasis on social institutions and vulnerability has contributed to advancing emerging pro-poor adaptation perspectives, "highlight[ing] differentiation in the cause and outcome of vulnerability" (Adger, 2006: 271).

2.4.2. Climate change vulnerability

In the climate change literature, an integrative systems approach has become dominant in recent years, which defines vulnerability with reference to ecological conditions and biophysical impacts, on the one hand, and the ability of human systems to adapt to climate-related impacts, on the other (Burton et al., 2002).

The IPCC (Parry et al., 2007b: 883) defines vulnerability as:

"The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity."

The synthesis of social and biophysical strands of the vulnerability concept reflected in the IPCC definition parallels the evolution from the first generation focus on impacts, to the more development-oriented approaches to climate change emerging out of more recent approaches (Brooks, 2003). O'Brien and colleagues (2007) summarize biophysical and social approaches to assessing vulnerability as relating to 'end point' and 'starting point' perspectives, respectively. The former defines vulnerability with respect to biophysical exposure to hazards, or as the potential damage incurred by a system from a hazard (Jones and Boer, 2003), and is characteristic of a focus on future climate impacts. This approach arises from the natural hazards field and focuses on the nature of hazard events rather than on the vulnerability and adaptive strategies of human populations. 'Starting point' assessments, on the other hand, understand vulnerability as a context "generated by social and environmental processes, including climate change, which limit the ability to cope with climatic and other stress" (Adger et al., 2006: 5; Allen, 2003). The latter is more closely related to the development and poverty approaches introduced above.

These alternative views, in turn, are characterised by different methodological approaches to analysing vulnerability (O'Brien et al., 2007). For instance, end point approaches are characterised by a "sequence of analyses beginning with projections of future emission trends, moving on to the development of climate scenarios, and thence to biophysical impact studies and then the identification of adaptive options" (Kelly and Adger, 2000: 326). The focus is on potential costs and benefits of future climate change impacts, aimed at determining "the extent to which different scenarios of greenhouse gas emissions lead to 'dangerous interference with the climate system' as discussed in Article 2 of the UNFCCC" (UNFCCC, 1992, cited in O'Brien et al., 2007: 75-6).

Alternatively, starting point approaches contend that addressing the underlying reasons that people are vulnerable to climate impacts—or to any shocks or stresses—in the present is a necessary first step to building capacity to adapt to potential future changes in climate (Burton et al., 2002). From this perspective, vulnerability to the current and potential impacts from climate change is differentiated across communities and even between individuals in the same household (Eriksen and Silva, 2009), due to factors like unequal access to resources and inequality. Case studies and household interviews undertaking livelihoods-style analysis comprise a popular approach to generating empirical evidence on social vulnerability, with a focus on assessing climate-related impacts as part of a wider context of vulnerability in which individuals are coping with the impacts of multiple stressors (O'Brien et al., 2004).

The following sub-sections review the adaptation literature, presenting a range of typologies for categorising the concept based on different dimensions. Particular concepts of relevance to a poverty-focused perspective on adaptation are also reviewed, including adaptive capacity, sustainable adaptation, and indigenous knowledge.

2.5. Approaches to adaptation

2.5.1. Types and scales of adaptation

The IPCC defines adaptation to climate change as "an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC 2007b: 869). Unpacking this definition illuminates some key dimensions, around the systems or actors concerned (ecosystems, government, donors, individuals), timing (short, medium, and long-term), degree of planning/preparation (planned or autonomous), scale (international, regional, micro-level), sector (private, public); and, type of adaptation activities (e.g. pooling or sharing risk (Agrawal, 2010)) (Smit et al., 2000; Smit et al., 2001; Adger et al., 2007).

Across approaches, the type of hazard with which a system is confronted is critical in determining potential options for adaptation. Impacts from gradual changes in climatic conditions are "actually experienced through changes in the nature and frequency of particular yearly conditions, including extremes; and it is to this variability that adaptations are made" (Smit et al., 2000: 226-7). The success of adaptation also depends on the nature of the hazard, for instance, it is commonly acknowledged that human and natural systems likely have greater capacity to adjust to gradual changes in mean conditions (e.g. average temperatures) than to

increasing incidence and severity of climate extremes (Rosenzweig et al., 2007; Schneider et al., 2001).

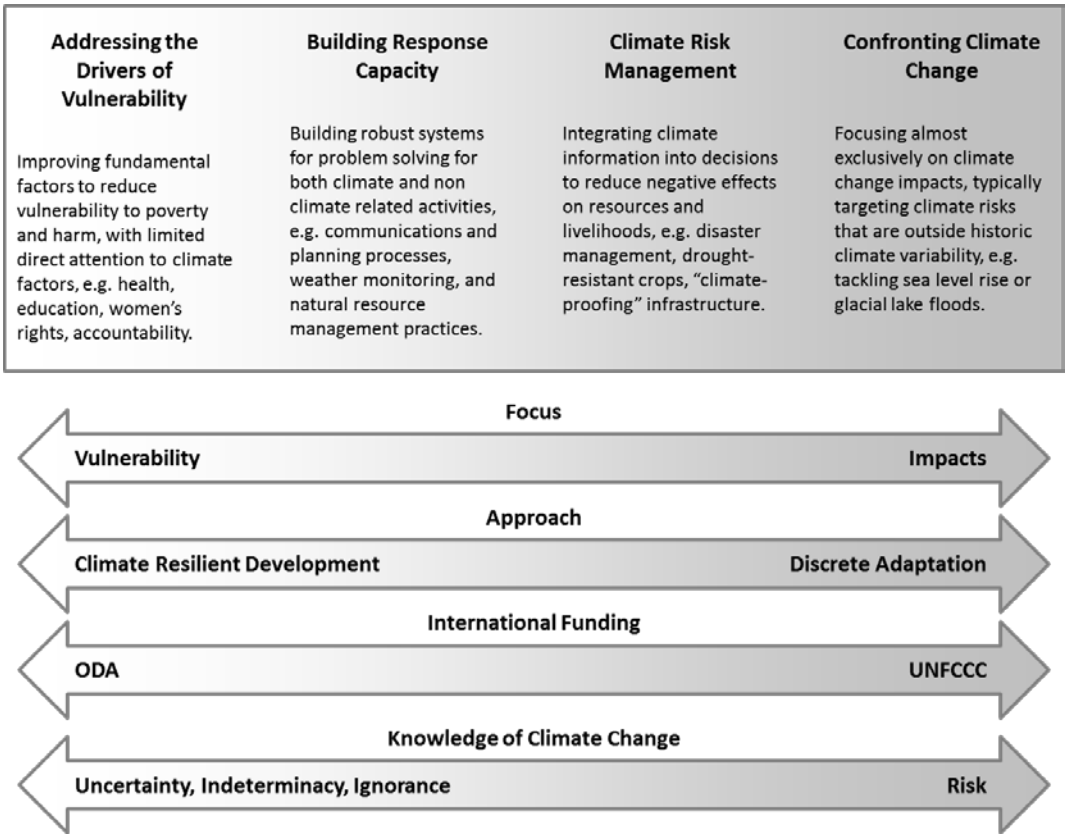
Adaptation takes place at all scales, from international, regional, and micro-level activities, and across multiple sectors. Adaptation can be anticipatory (i.e. purposeful and pre-planned) or reactive (*ex post* response); planned or 'autonomous'. *Planned adaptation* refers to activities that are consciously undertaken and anticipatory. At the national level, planned adaptation is dominated by climate and economic modelling approaches (based on aforementioned "first generation" approach), tend to be highly top-down and sector-specific, e.g. National Adaptation Plans of Action (NAPA), and deliver large-scale infrastructural (building of sea walls) or technological (development of drought-resistant crop varieties) solutions. The focus here is on the climate hazards themselves, rather than on the factors and processes that influence the ability of human populations to respond to impacts from them.

Community-based adaptation (CBA) is a community-driven agenda for planned adaptation that emerged in response to these top-down, managerial approaches. This approach is more aligned with second-generation climate change research and practice, and tends to be more the remit of NGOs and civil society organizations engaged in natural resource management or community development in low-income countries. CBA emphasizes empowering local communities to identify and pursue their own needs and objectives with respect to climate change adaptation, and acknowledges the importance of linking international funds for adaptation, channelled through national governments, to support local adaptation (Reid and Huq, 2007; Ayers and Forsyth, 2009). Over the last decade a large number of pilot CBA programmes have been implemented around the world, however, this approach is still in early phases and has a ways to go in terms of developing a theory of practice. While a focus on the community level is critical for highlighting the adaptation-related needs of poor and vulnerable communities globally, critiques of early generations of CBA point to the need to explore the sub-community level in order to support a truly pro-poor, community-driven approach. Towards this end, CBA practitioners are urged to engage with well-established concepts from the development and livelihoods fields around household level vulnerability, coping, and risk-spreading strategies like diversification, as well as to build linkages with on-going development and poverty reduction interventions in their areas of operation (Sabates-Wheeler et al., 2008). More recent perspectives on CBA incorporate consideration of the role of: social networks, climate and forecasting information, power, and culture, in shaping community-level adaptation and adaptive capacity (e.g. Ensor and Berger, 2009; Ensor 2011).

Autonomous, or *spontaneous* adaptation is not planned or implemented by governments, donors, or NGOs (Adger et al., 2007; Malik et al., 2010; Fankhauser et al., 1999). Despite an increase in international funding for adaptation, resources are still insufficient to support planned adaptation programmes on a scale commensurate with needs. Therefore many countries will need to depend on largely autonomous adaptation initiatives by individuals, households and communities—this may be particularly true for extremely poor communities in settings where they are already being missed by on-going development programmes and safety nets. Assessing the extent and likelihood of successful autonomous adaptation therefore represents an area of great interest, since defining the level of 'dangerous anthropogenic interference with the climate system' depends in large part on the vulnerability and capacity of systems and populations to adapt to different degrees of climate change (Smit et al., 2000). Emerging empirical studies indicate that autonomous adaptation usually occurs in response to multiple stimuli, rather than a climate-related impact alone, and is often reactive and ad-hoc (Adger et al., 2007; Schneider et al., 2001). Many studies conclude that autonomous adaptation alone is unlikely to be sufficient to ameliorate the negative impacts associated with future climate change (Malik et al., 2010). In particular, autonomous adaptation among poor communities is constrained by a range of factors, including "economic, social, technological, institutional and political conditions" (Schneider et al., 2001: 88-9).

In reality, "the line between autonomous and planned adaptation, or between private and public adaptation is blurry"; an array of different types of adaptation involving both private agents and governments exist between these two extremes (Malik et al., 2010: 4). Autonomous adaptation is influenced by the wider context of policy agendas in which it occurs, and many policy areas outside of climate change—most notably development, including social protection, and disaster risk reduction (DRR), (Arnall et al., 2010)—also represent a sort of adaptation, and certainly include activities consistent with climate change adaptation. Some authors (e.g. McGray et al., 2007) have identified a 'continuum' of approaches (Figure 1), between development-style activities that aim to increase resilience by addressing the 'drivers' of vulnerability—such as health, education, and rights, at one extreme; and discrete adaptation, or response to specific climate conditions and impacts, at the other.

Figure 1: Continuum of adaptation activities



(Adapted from Tanner and Mitchell, 2008 and McGray et al., 2007)

Various other models exist for classifying different types of adaptation; these frameworks apply in assessing both planned or autonomous adaptation activities at various scales. The choice typology (Burton et al., 1998) categorizes adaptation according to choice options open to individuals or decision-makers as they respond to climate-related impacts. These include: "bear losses, share losses, modify threats, prevent effects, change use, and change location". The first category in this typology may be particularly relevant to exploring responses by extremely poor communities, for whom lack of access to resources for successful adaptation may mean they have little choice but to "bear losses" (ibid.).

Some researchers frame adaptation options around types of activities, rather than choice. For instance, Agrawal (2010) presents a framework in which adaptive and coping strategies involve activities that relate either to pooling or sharing risk, including: mobility; storage; diversification; communal pooling; or market exchange. Wisner and colleagues (2003: 114-119) identify similar types of coping and adaptation, distinguishing between pre-event coping that occurs before a shock has hit, including preventative strategies and impact minimising strategies, like building up of stores of food and saleable assets, diversifying production and income sources, development of social support networks, and post-event coping strategies.

2.5.2. Coping and adaptation

Coping is an essential concept for exploring household strategies for dealing with climate-related shocks and stresses; however coping and adaptation are not explicitly distinguished from one another in the mainstream climate change literature (e.g. IPCC Assessment Reports). While some authors identify 'coping ability' as the capacity to survive, reserving 'adaptive capacity' for "longer term or more sustainable adjustments" (Vogel, 1998, cited in Smit and Wandel, 2006: 287), further flushing out of the factors, timescales, and outcomes that distinguish coping from adaptation in relation to climate change is necessary. Insights from other fields may prove helpful. Approaches drawn, for instance, from anthropology (D'Souza, 1985), livelihoods, and food security literatures (Davies, 1993; Devereux, 2001), distinguish between coping and adaptation where the former refers to activities undertaken to "survive *within the prevailing rule systems.* When adaptation occurs, such rule systems (or the moral economy) themselves change, as do the livelihood systems in which these rules operate" (Gore, 1993: 16).

Ellis (2000) citing Webb et al., (1992), distinguishes between risk management activities as *ex-ante*, implying forward planning, and coping as *ex-post* activities to address the impact of shocks and crises. This parallels the distinction drawn in the climate change literature between reactive and proactive adaptation. However, adaptation and coping have different timescales, with implications for the relationship between coping in the present and adaptation over the longer term. This link is crucial in that strategies to cope with climate-related shocks, variability, and seasonality in the present may either undermine or support adaptation activities in the future—i.e. coping can be maladaptive, and understanding local coping strategies and supporting ones that work is both a gap and priority highlighted in many pro-poor perspectives on climate change adaptation (Eriksen et al., 2005).

Insights from food security and livelihoods research also link coping capacity with access to and ownership of assets, or entitlements, including material sources of entitlement, and the context (i.e. social and household relations) in which these are distributed (Ellis, 2000; Swift, 1989; Chambers, 2006). Variation in asset endowment and entitlements means that coping capacity and the strategies pursued by different households and individuals vary, often exhibiting considerable complexity and ingenuity. Sequencing of coping strategies and trade-offs have been the subject of much study, and Corbett (1988) found that, contrary to dominant assumptions in the rural livelihoods literature, households often prioritize preservation of key livelihoods assets over immediate food needs until the point of destitution. Blaikie and colleagues (1994) similarly report that coping in the wake of a disaster is more complex than

prioritization of basic needs, but also includes attempts to maintain other needs, such as human dignity and respect. Improved understanding of these traditions is particularly relevant, as it can help to build an evidence base around how coping in the present may give an indication of what vulnerability and adaptation needs will be in the future.

Integration of insights like these, from various development and social science fields, is characteristic of emerging poverty-focused perspectives on climate change adaptation. These are introduced below, before discussing certain poverty-focused approaches of relevance to this approach, including adaptive capacity, sustainable adaptation, and an emerging emphasis on the role of indigenous knowledge.

2.5.3. Poverty-focused perspectives on climate change adaptation

Both social justice and instrumental arguments support calls to prioritize the needs of the poorest and most vulnerable in policies for mitigation and adaptation (Dow et al., 2006; Annan, 2007; Vernon, 2008). Concerning the former, "it has been estimated that the poorest billion (globally) are responsible for only three per cent of the world's total carbon footprint" (Hedger and Tanner, 2008: 3), yet poor people in lower-income countries are disproportionately vulnerable to the impacts associated with anthropogenic climate change. Secondly, it is widely believed that the gains from growth and poverty reduction activities are at risk of being eroded, if not entirely wiped out, by changing climatic conditions and climate extremes (CCCD, 2009; Stern, 2006; ADB et al., 2003), especially in disaster-prone countries with pervasive poverty, like Bangladesh (Tanner et al., 2007; Alam and Murray, 2004).

Poverty-focused perspectives on adaptation aim to ensure that, at a minimum, climate change and its associated impacts should not further entrench poor and vulnerable people. This position is often taken further, to argue that climate change adaptation should reduce the vulnerability of poor people before, and faster than, that of non-poor people, in line with social justice and equity dimensions inherent in the global distribution of responsibility for, and impacts from, climate change (Mitchell and Tanner, 2008; Vernon, 2008; Prowse and Scott, 2008). This relative pro-poor adaptation position raises questions, in turn, about the potential of asset transfers and redistribution between poor and non-poor people and countries as a basis for pro-poor adaptation (Tanner and Mitchell, 2008: 32).

One subset of poverty-focused approaches includes screening of development portfolios to 'climate proof' on-going activities and build climate change considerations into development projects and wider strategies, including Poverty Reduction Strategy Papers (PRSPs) (Tanner et al., 2007; Tanner, 2008). Borrowing from livelihoods perspectives, asset based approaches are

also beginning to emerge as central in the pro-poor adaptation literature (Prowse, 2008; Prowse and Scott, 2008; Moser and Satterthwaite, 2008). This is based in part on evidence that the assets of poor people are at risk of being eroded in the face of shocks and stresses, or as a result of the strategies undertaken to address them, and that this can undermine future livelihood security and household well-being (Ellis, 2000; Davies, 1993; Swift, 1989; Corbett, 1989). Asset based approaches are useful for disaggregating vulnerability into component categories, thus allowing for broader analysis than money-metric approaches (focused on income and consumption), and facilitating identification and measurement of multiple livelihood components on the ground. The asset based approach also recognizes that while people are vulnerable and restricted by lack of assets and voice, this does not mean that they lack agency or the capability to address, act, and cope in the face of shocks and stresses (Moser, 1998).

Asset based approaches have the tendency, however, to overemphasize more tangible resources (e.g. economic, technological, infrastructure). While these categories are important, a consideration of the wider contextual and institutional factors would strengthen the approach, for instance by revealing processes that may be impeding adaptive response by some groups, while facilitating certain options for others (Eriksen et al., 2005; Carr, 2008; Adger et al., 2009). This perspective requires disaggregated empirical research to understand the relative impacts on, and adaptation needs, of different groups of poor people. Understanding how vulnerability is differentially experienced at sub-community and intra-household levels is an essential underpinning for effective pro-poor adaptation (Mitchell and Tanner, 2008; Scott, 2008; Polack, 2008; Eriksen et al., 2007). The pro-poor approach prioritizes the views of the vulnerable themselves (Tschakert, 2007; Mitchell et al., 2007) and local knowledge about climate risks and coping, pointing out that ‘expert knowledge’ is not adequate for understanding local level vulnerability and adaptation needs, or to support ground-up approaches to adaptation (e.g. CBA).

2.5.4. Indigenous knowledge

The central role of vulnerable communities, their knowledge and coping behaviours emerge in a small but growing literature on indigenous knowledge Local indigenous knowledge and experience, for instance in coping with climate variability and seasonality in the past and present have much to contribute to the design of planned adaptation (Harrison et al., 2007, cited in Ensor, 2011). Some argue it is the basis for designing the kinds of interventions that will be participatory and effective in responding to local needs (Robinson and Herbert, 2001; Sillitoe, 2007). However, until recently, climate change scientists have largely ignored indigenous knowledge and local adaptation (Byg and Sallick, 2009). In relation to poor countries, this is in part because much of the data available and reported by the IPCC comes from climate

modelling studies in Northern Hemisphere mid- and high-latitude regions, while "documentation of observed changes in tropical regions is still sparse" (Rosenzweig et al., 2007: 117).

Various authors also discuss the tendency of the climate change field—and of scientists more broadly—to disregard data gathered in methods that are 'non-scientific' according to the tenets of Western science (Berkes, 2002; Huntington, 2000; Byg and Sallick, 2009). This viewpoint dismisses important contributions to climate change science—which remains fuzzy on details pertaining to local settings and change—that could potentially derive from a wealth of detailed, intimate knowledge of natural landscapes and ecosystems that has been built up over generations. Sillitoe (2007) argues that the dichotomy between local knowledge and (Western) science is a false one that ignores the fact that the two have borrowed from one another for generations. For some, the separation between 'local knowledge' and 'science' "smacks… of the discredited distinction between primitive and civilized thought" (Frake, 1983; Ellen, 2004, both cited in Sillitoe, 2007). The existence of diverse sciences—one global, many local sciences—should instead be regarded as an illustration of "the richness of human inventiveness; to suppose that they reflect different cognitive processes is fallacious, although they do reveal varying preoccupations in life and differing bodies of knowledge" (Sillitoe, 2007: 8).

Indigenous knowledge and experience, as well as local experiences of and ways of conceptualising climate change, are gaining ground in the climate change literature. Various studies report that local communities perceive changes in weather patterns and extreme events on the ground, many of which match up with the meteorological record (e.g. Thomas et al., 2005; Thomas et al., 2007; Dinar et al., 2008). While local communities have a long history of adapting and coping with impacts of weather and climate, and the knowledge base around these strategies is growing (e.g. McLean, 2010), "climate change poses novel risks often outside the range of experience" (Adger et al., 2007: 719). This reflects the central importance to successful local-level adaptation of an approach predicated on dialogue between climate science and local indigenous knowledge, and built around an understanding of local needs. However, 'expert knowledge' and planned adaptation continue to dominate climate change discourse and policy space, and while ground-up approaches that prioritize local knowledge (e.g. CBA) are gaining momentum, they still represent a minority and meet with difficulty in terms of scaling up and mainstreaming (Sabates-Wheeler et al., 2008).

2.5.6. Adaptive capacity

One reflection of the growing interest in community-level, pro-poor perspectives in the climate change literature is a broadening of focus in research from *adaptation*—interventions planned to address specific, known climate change impacts—to *adaptation* and *adaptive capacity*, or "the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (IPCC, 2007b: 869). This broader concept first emerged in the IPCC's Third Assessment Report; previous reports had focused solely on adaptation interventions, "rather than the socio-political and institutional precursors to these responses" (Burch and Robinson, 2007: 306). The emphasis on capacity takes as a starting point the scientific uncertainty of projecting the exact nature and timing of impacts from climate change at the local level in poor countries, and therefore the inherent difficulty of designing specific interventions. Uncertainty should be met "head on" through emphasis on the resources, factors, and processes that affect people's ability to act and change in the face of future impacts that are uncertain (Ensor, 2011: 5).

There is not yet a widely agreed definition of adaptive capacity (Vincent, 2007), although most approaches acknowledge the challenge of measuring the capacity for action directly, and therefore propose sets of indicators, usually made up of suites of assets that may reflect an individual, household, or nation's ability to adapt to impacts associated with climate change. Most approaches also acknowledge the highly context specific nature of adaptive capacity, varying across different locations, and even among members of the same household or community, with some determinants being "mainly local (e.g. presence of a strong kinship network which will absorb stress) while others reflect more general socio-economic and political systems (e.g. the availability of state-subsidized crop insurance)" (Smit and Wandel, 2006: 286-7).

Most early adaptive capacity assessments have been carried out at the national or sectoral level, with analyses of individual, household, and community-level determinants only recently emerging (Jones et al., 2010). These approaches tended to focus on tangible assets, particularly financial, infrastructural, and technological, and often neglected the social and power-related dimensions of adaptive capacity (ibid.). In recent years, however, there has been a move in the literature towards exploring the processes, institutions, and wider context that influence the capacity to adapt to uncertain change, including at the level of individuals, households, and communities.

Emerging approaches are exploring what adaptive capacity looks like at scales below the national level. Marshall and colleagues (2010) propose sets of indicators for factors that shape adaptive capacity corresponding to individual, household, and community levels. These include dimensions such as perception of risk and attachment to place and occupation, which go part of the way towards filling a gap identified by Burch and Robinson (2007). They point out that some approaches to individual-level adaptive capacity neglect the importance of factors that influence the relationship between capacity and action. In other words, possessing a certain set of assets that might comprise elements of 'adaptive capacity' is not enough to explain if, how, and when different individuals will turn that capacity into action. Burch and Robinson (2007: 310) echo Haddad (2005)'s call for assessments to explore "the normative and motivational context of adaptation".

While progress in translating these areas of research into policy interventions has been limited, it has nonetheless become common in both domains to speak of and attempt to explore the more amorphous elements of the livelihood context, i.e. policies, processes, institutions, social capital (e.g. Chapin et al., 2006; CCCD, 2009; Marshall et al., 2010). However, most adaptive capacity assessments are interested in these intangible dimensions insofar as they mediate the distribution of and access to tangible resources and assets. Ensor (2011: 2) argues for an alternative focus, on "the processes through which communities are able to make changes to their lives and livelihoods in response to emerging environmental change". This is echoed by the view that what is new and important about an adaptive capacity perspective is exploring "what a system *does* that enables it to adapt, rather than what a system *has"* (WRI, 2009, cited in Levine et al., 2011: 5). Areas where policy could therefore support local adaptive capacity include (1) power sharing; (2) knowledge and information; and (3) experimentation and testing. This kind of approach would require a "reorientation of development thinking" to focus on processes—through which adaptation outcomes would emerge as a result—rather than the programme-based focus on interventions and outcomes characteristic of development (Ensor, 2011: 33).

2.5.7. Sustainable adaptation

Sustainable adaptation also emphasizes the need to fundamentally reorient how development takes place in order to achieve poverty reduction and sustainability in the context of a changing climate. This perspective emerged out of the recognition that the long-term implications of adaptation interventions themselves are largely unknown, and the few studies that do assess them suggest that outcomes may run counter to the principles of sustainable development (Eriksen and Brown, 2011). Despite far-reaching calls that poverty reduction and climate

change adaptation must and can go hand in hand, the evidence suggests that poverty interventions (e.g. livelihood diversification) sometimes end up increasing vulnerability (price fluctuations or market shifts) (Brown, 2011: 28).

Sustainable adaptation proponents argue that interventions should aim to address the area of overlap between poverty and vulnerability (Eriksen and O'Brien, 2007). While recognizing that poverty and vulnerability are closely related but distinct, the interface is identified with reference to the factors and processes that lead to a "failure to secure well being in the context of climate-related stresses" (ibid.: 340). More recent approaches define adaptation that is sustainable as that which contributes to social and environmental sustainability, echoing the intra- and intergenerational equity principles of the sustainable development perspective (Eriksen et al., 2011). Others point out, however, that the sustainable adaptation concept risks suffering the same pitfalls as sustainable development did, unless it truly challenges what is "unsustainable about development" (Brown, 2011: 29).

In particular, a more nuanced understanding of the complexity of connections between poverty and vulnerability is required, including a disaggregated perspective on poverty and a focus on the underlying root causes of vulnerability. For instance, exploring the particulars of climate-related vulnerability and modes of response from the perspective of different categories of poverty, i.e. chronic, transient (Tanner and Mitchell, 2008), and integrating insights from poverty and development perspectives on vulnerability (Section 2.4.1). As the basic principles of this approach stand now, a majority of activities undertaken autonomously by extremely poor individuals and communities would actually be deemed 'unsustainable' (Brown, 2011). This stands in contrast to calls to base pro-poor adaptation on local strategies for responding to climate impacts. While some local responses might lead to maladaptation in future, they do provide an important basis for the design of planned adaptation interventions.

2.6. Critical gaps for supporting a pro-poor adaptation position

A great deal of progress has been made in a short time period in terms of a broadening of scope in climate change research to include focus on far-ranging social science and development themes, including poverty-focused perspectives. However, these approaches are still in their early stages, and there has been little progress in terms of translating these concepts into policy interventions on the ground. The literature review above highlights some of the critical gaps that must be addressed in order to further develop a ground-up, pro-poor approach to climate change adaptation. These gaps relate both to the need for these perspectives to engage with poverty and livelihoods fields of theory and practice, on the one hand, and to the need for more empirical

evidence around the nature of climate-related vulnerability and coping/adaptation at the local level in poor countries, on the other.

Some of these gaps include:

(1) Focus on the poorest of the poor—the emphasis of research even among pro-poor perspectives remains on the asseted poor (i.e. poor farmers). This is a critical gap, given that Africa and South Asia, two regions with the highest concentrations of chronic poverty, are also likely to experience the most severe impacts from climate change (Scott, 2008).

(2) Exploration of the sub-community level, in particular at the level of households and individuals. This is critical for gaining insight into differentiation in vulnerability and adaptive capacity across different groups of poor people (e.g. different livelihood or social groups). This type of analysis represents an essential underpinning for supporting community-driven adaptation approaches that prioritise the needs of the poorest and most vulnerable households and individuals within the community.

(3) Related to an over-emphasis on poor but asseted groups, is the tendency to over-emphasize tangible assets generally in emerging pro-poor perspectives (e.g. asset based approaches). While intangible factors and processes are gaining ground in the literature, this tends ultimately to be about how these less tangible dimensions affect the distribution of tangible assets or access to these. Some approaches, on the other hand, take a more process-oriented view than the traditional outcomes and project oriented perspective characteristic of development (WRI, 2009; Jones et al., 2011). This orientation is particularly useful in an area like climate change adaptation, in which change and unprecedented impacts are certain, but the timing and local nature of these remain unclear (Ensor, 2011).

2.7. Conceptual framework

This research explores the climate—poverty—livelihoods nexus among extremely poor households and individuals in two fieldwork villages in Gaibandha District of Northwest Bangladesh. The livelihoods framework is used as a conceptual model and guide to data collection for analysing vulnerability among respondents. The re-framed concepts of *resources* (rather than capitals) and *mediating factors*, i.e. the factors and processes that influence levels of climate-related vulnerability and adaptive capacity among extremely poor respondents, are

added onto the livelihoods approach, forming core components of the Mediating Factors Framework.

This approach entails examination of the resources that underpin livelihoods and the various ways in which vulnerability to climate-related shocks and stresses affects livelihoods strategies among extremely poor households and individuals, and, conversely, the ways in which the experience of extreme poverty may constrain and/or enable adoption of alternative coping and adaptive strategies across individuals and households. A particular aim has been to explore the extent of *differentiation* in climate change vulnerability and how this is experienced across the various sub-groups and individuals that make up the 'extreme poor', and affects abilities of different people to cope with and adapt to climate events and changing conditions. These sub-groups include respondents engaged in different livelihood activities (mainly river-based vs. agricultural) and social categories (i.e. men, women, children, elderly, disabled), as well as differentiation that may exist across individuals within these groups. For instance, not all fishermen in a community are affected in the same ways and to the same degree by a flood or storm, just as not all young children or women are equally able to cope with the effects of drought, and so on. Rather, additional patterns of differentiation emerge across individuals who pertain to the same livelihood or social group, and the Mediating Factors Framework is designed to capture these additional dimensions.

The following sub-sections review the conceptual underpinnings for the Mediating Factors approach, including the livelihoods framework, and use of the concepts of resources and mediating factors. The chapter concludes by introducing the Mediating Factors Framework.

2.7.1. Livelihoods framework

The Sustainable Livelihoods Framework provides a model for conceptualizing and mapping the multiple dimensions of poverty, including analysis of resources that underpin household strategies to build and maintain a standard of living, and the processes and institutions that shape these strategies. This framework builds on earlier entitlements-based approaches and now dominates the discourse on rural poverty and vulnerability (Wood, 2005). It is useful in that it deals with the various elements that comprise a livelihood, and connections between them, including: wider factors (i.e. sources of risk and vulnerability; institutional, and policy contexts); assets (including a mix of tangible and intangible resources); and the activities undertaken to transform a set of resources into a livelihood (Ellis, 2006). The sustainability dimension, albeit seldom a primary focus in the context of rural poverty analysis, is of central relevance to the climate change debate; it suggests that "... a livelihood is sustainable when it

can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (Chambers, 2005: 2).

Asset holdings are considered the 'building blocks' of livelihoods (Ellis, 2006), and are presented in the framework as various forms of 'capital' that a household or individual either owns or has access to. These categories are not always an accurate reflection of the specific assets and livelihoods of particular people on the ground, but they provide a useful way to conceptualize how different kinds of assets relate to household well-being, and the policy environment (i.e. human capital links to social policies, for instance). The set of capitals employed in livelihoods research usually includes the following (ibid.: 346): (1) human capital, (skills, health, education); (2) physical capital (produced investment goods); (3) financial capital (money, savings, access to loans); (4) natural capital (land, water, trees, etc.); and (5) social capital (networks and associations).

Differences exist across specific frameworks and approaches, with many researchers identifying additional categories in accordance with their own analytical focus. Some draw distinctions, for instance, between assets that correspond to investments, stores, and claims (Swift, 1989). Others distinguish between productive and non-productive assets, or those livelihood components that are material and tangible, on the one hand, and those that are not, such as social capital, household relations (Moser, 1998), or the policy context in which livelihoods are pursued, on the other. Various definitions of *social capital* exist. The term is generally used to refer to the wider community context, including social networks, relationships, and structures of claims and reciprocity associated with belonging to different groups in a given local setting (Ellis, 2000). Some approaches emphasize the positive aspects of social networks and capital over constraints posed by formal and informal groups and networks, especially for extremely poor and excluded individuals. In particular, Putnam's perspective of society, communities, and networks as harmonious and positive (i.e. Putnam, 1993), contrasts with approaches like Bourdieu's Marxist emphasis on class struggle, the exclusionary nature of networks among the rich, and the centrality of other kinds of capital, i.e. cultural, economic (Bourdieu, 1986).

The *Transforming Structures and Processes* (DFID, 1999) component of the livelihoods framework is a more recent add-on. It supplants the earlier *Policies, Processes and Institutions* (DFID, 1991) element of the framework, which provides a guide for conceptualizing the influence of wider contextual (institutional and policy) factors on the ability of households to translate asset portfolios into livelihoods (Ellis, 2000). The additional dimension of 'influence and access' has also been recently added, to facilitate exploration of the relationship between

specific categories of livelihood assets, on the one hand, and transforming structures and policies, on the other (ibid.). Various models exist for analysing the wider contextual dimensions of livelihoods. Some authors draw broad divisions between 'the vulnerability context' and 'transforming processes' (policies, institutions, laws, incentives, social relations) (ibid.); others between 'contexts, conditions and trends', on the one hand, and 'institutions and organization', on the other (Scoones, 1998). Ellis (2000: 37-8) distinguishes broadly between internal and external factors: (1) social relations, institutions, and organizations (endogenous to the social norms and structures of which households are a part); and (2) trend and shock factors (exogenous factors including unforeseen shocks, or economic trends and policies). Vosti (1998: 1497, cited in Ellis, 2000: 37) encompasses all these considerations into a single category of 'conditioning factors'.

The analytical focus common among most approaches to exploring these 'mediating processes' (Ellis, 2000), is the way in which the different elements of a given context—be they policies, formal institutions, or informal norms—influence "access to assets and their use in pursuit of viable livelihoods" (ibid.: 37). Therefore while, on the one hand, intangible processes and factors have become central in livelihoods-based approaches, the emphasis in exploring these issues tends ultimately to be about the distribution of and access to tangible assets (e.g. financial, technological, physical).

2.7.2. Resources and mediating factors

The conceptual approach in this research builds on the livelihoods framework introduced above, but instead employs the re-framed concepts of resources (rather than capitals) and mediating factors (rather than policies, processes, and institutions, or other variations). These choices have been made in order to achieve a truly respondent-led approach to research, in which categories of resources and elements of the wider local context are not pre-defined, but rather are left up to respondents themselves to define and categorize.

The Resource Profile Framework (Lewis et al., 1993) employs a broader and less 'taxonomic' approach through use of 'resources' in order to accommodate a wider range of livelihood components. This opens space for consideration of cultural and spiritual factors, for instance, as well as community identity and relations, whilst paying greater attention to the variable, fluid nature of resource values and the relationships and activities that underpin this fluidity. The concept of resources is preferred in this literature to the "snapshot possession of (fixed) stock" assets connoted by use of the term 'capitals' (Wood, 2005: 4-5). This research also uses the term resources rather than capitals, in line with this approach in order to avoid the use of pre-defined

categories of assets that may be less relevant in exploring the livelihoods of respondents in field site locations. Instead, in this research, central focus is on how respondents themselves define and categorize the resources they consider important to their livelihoods and coping strategies.

Similarly, the concept of 'mediating factors' is preferred because it is broader and less defined by a pre-set categorization of factors that may not neatly correspond to 'policies, processes or institutions' or 'social capital.' The use of this term is meant to signify a wider approach than that traditionally taken in livelihoods analyses to thinking about how an individual's relationships or connections and wider contextual dimensions affect livelihoods and vulnerability to climate. In terms of conceptualizing *social capital,* associations (relationships as well as membership in different groups) remain of central importance; however conceptual insights will be taken from village studies around the role of things like local power structures, class, and gender relations. A strong research tradition around these issues exists in Bangladesh (i.e. BRAC, 1980; Lewis and Hossain, 2008; White, 1992; Hartmann and Boyce, 1983); the approach taken here incorporates exploration of these dimensions.

In relation to exploring the wider context ('policies, institutions, and processes' component), the mediating factors approach extends analysis of these dimensions beyond the traditional focus on how they influence patterns of distribution and access to resources. In this approach, focus will also be placed on the factors and processes that shape the 'motivational context for adaptation' (Haddad, 2005). These include, for example, the factors that underpin local perceptions of risk attached to different kinds of hazards, beliefs and ways of understanding perceived changes in climate, as well as respondent views about what kinds of adaptive action are possible, what actions are impossible, and why different respondents hold these views. Emerging literature around community, household, and individual level determinants of adaptive capacity that addresses such factors provides a conceptual guide (see Section 2.5.6).

2.7.3. Mediating Factors Framework

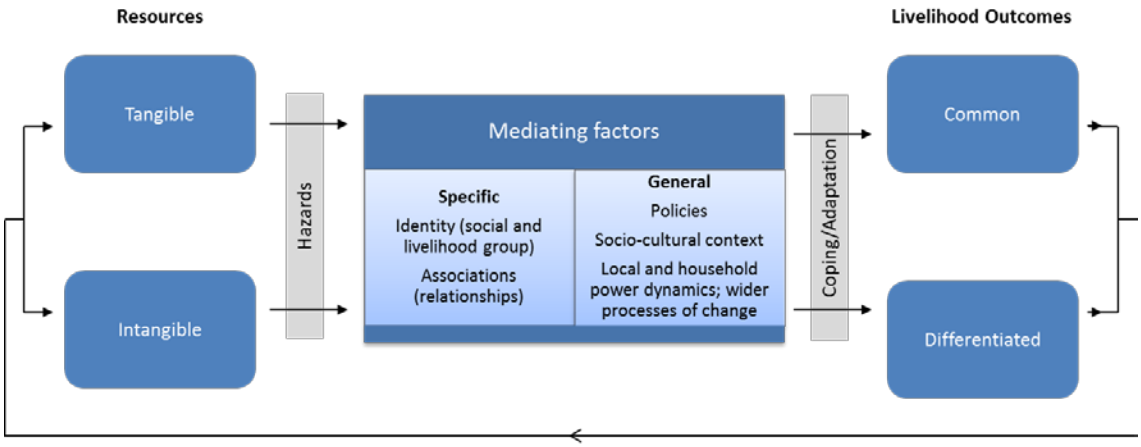
Frameworks for exploring vulnerability and adaptive capacity both provide important insights, and to the extent that the broad purpose of exploring vulnerability is to also understand ways of supporting adaptive capacity, elements of both are included in this conceptual approach. Rather than focus solely on one or the other, the framing in this research includes consideration of both (1) factors that reflect the nature of vulnerability and poverty among respondent individuals and households, as well as (2) processes and elements that might influence adaptive capacity.

In this research, vulnerability is defined from a 'starting point' perspective (O'Brien et al., 2007), as a context that exists prior to the occurrence of a hazard, but that determines the pattern of outcomes from it (Brooks, 2003; Allen, 2003) (See Section 2.4.2). Vulnerability is a function of climatic and non-climatic factors, is comprised of: (1) exposure to biophysical impacts; (2) sensitivity; and (3) adaptive capacity (Parry et al., 2007b), and is differentiated across groups of people. This approach requires to vulnerability taking a broad view of resources, beyond a focus on tangible resources to explore the role of intangible resources, factors, and processes that underpin vulnerability and adaptive capacity, as well as the various ways in which climate-related impacts interact with multiple other sources of risk and vulnerability in the field site areas (O'Brien et al., 2004).

Frameworks for assessing community, household, and individual-level determinants of adaptive capacity also guide this approach. Here, importance is placed on resource holdings as well as the wider context in which coping and adaptation occur. This includes exploration of the factors that shape the relationship between capacity and action (or incapacity and inaction). This includes, for example, perceptions of risk, modes of conceptualizing perceived climatic change by local populations, place and occupation-based identity (Marshall et al., 2010). These areas are highlighted in terms of the barriers and limits they may present for respondents in fieldwork sites in undertaking adaptation (Adger et al., 2007; 2009), as well as potential opportunities.

The Mediating Factors Framework thus captures elements related to both adaptive capacity and vulnerability:

Figure 2: Mediating Factors Framework



Tangible and intangible resources include the livelihoods capitals as a basis, but extend to any kind/category of resource fieldwork respondents themselves identified as important to their livelihoods.

Hazards refer to all shocks and stresses, climate-related or otherwise, also as identified by respondents.

Mediating factors underpin differential levels of vulnerability and adaptive capacity among respondents, in part but not only by influencing households' and individuals' abilities to access and deploy resources for coping with shocks and stresses, but also by shaping motivations for coping, perceptions, and beliefs about climate change. Mediating factors operate at the individual level (e.g. identity-based characteristics, such as livelihood and social group, networks, and relationships), others at the household and community levels (e.g. broader processes of change, local power dynamics, institutions) (Smit and Wandel, 2006).[6] These 'specific' and 'general' components in the Framework above serve as a guide to the types of factors that might mediate vulnerability and adaptive capacity, drawn from the literature reviewed above.

Coping/adaptation refers to the activities undertaken by respondent households and individuals in preparation for and/or response to climate-related impacts. This includes response to both the direct effects of hazards, on the one hand, and economic and social consequences of hazards, on the other (Smit et al., 2001; Levine et al., 2011). This also includes consideration of autonomous and intervention-based coping and adaptive activities undertaken by respondents.

Livelihood outcomes (common and differentiated) with respect to both (1) vulnerability to impacts from future shocks and stresses; and (2) adaptive capacity, now and in the future under likely projected impacts from climate change in the fieldwork area. Outcomes are also assessed in terms of how they are distributed across the respondent group, with a focus on areas of differential outcomes as well as commonalities. The Framework captures both elements of differentiation that operate at the level of groups—such as social groups (e.g. women, children, the elderly, disabled individuals), and livelihood groups (e.g. farmers, agricultural day labourers, fishermen), as well as patterns of differentiation across individuals within these wider groups. The list of mediating factors that this approach generates in any given location may therefore be wide-ranging, including not only factors that relate to livelihood/social group

[6] Following from North (1990: 3) institutions here are taken to mean "formal rules, conventions, and informal codes of behaviour that comprise constraints on human interaction".

associations, but also those that may mediate differentiation within and across these more obvious livelihood and social group divisions.

2.8. Conclusions

This chapter reviewed relevant bodies of literature around global climate change, vulnerability, and adaptation; and the conceptual approach adopted in this research. The review highlighted an evolution in climate change research over recent years, from an initial focus on future climate impacts and options for adaptation to a more recent emphasis on the impacts of climate variability and change in the present. With this broadening of scope has come an increasing focus on the wider context in which climate shocks and stresses occur, and in particular the non-climatic factors and processes that shape vulnerability and the capacity of communities, households, and individuals to adapt to change and uncertainty more generally. This research is part of that evolution, aiming to fill gaps that still remain in the empirical knowledge base, in particular through focusing on extremely poor people, a relatively under-researched group in the climate change field.

The bodies of literature reviewed in this chapter contribute to exploring the overarching research question: *What is the nature of vulnerability to climate change impacts among extremely poor households and individuals in the fieldwork areas?* The approach taken to answering this question departs from a 'starting point' understanding of vulnerability (Section 2.4.2), highlighting the importance of both biophysical and social factors and processes underpinning livelihood vulnerability and adaptation. Development and livelihoods fields offer a rich tradition of studying household vulnerability and coping (Section 2.4.1; Section 2.5.2), and are gaining ground in the climate change literature on vulnerability and adaptation. These various strands of literature highlight, for instance, the role of non-climatic factors in shaping differentiation across groups of people in terms of how climate-related hazards are experienced and responded to. These approaches therefore provide important insights for exploring the main hypotheses set out in this research, that *climate change is altering the pre-existing vulnerability context; that vulnerability is highly differentiated across individuals and households, and that various 'mediating factors' underpin differentiation and influence coping and adaptive response.*

Emerging poverty-focused perspectives on climate change vulnerability and adaptation provide a critical theoretical grounding for this thesis (Section 2.5.3). In this tradition, insights from indigenous knowledge literature (Section 2.5.4) are central to the approach taken here in that

they highlight the important role of the local knowledge communities have about climate and how to respond to climate-related shocks and stresses. This resonates with the thrust of this research, which places central focus on the views and perceptions of respondents in Northwest Bangladesh. In addition, sustainable adaptation approaches (Section 2.5.7) are useful, given the focus here on extremely poor people and the emphasis of that literature on addressing not only the connections and overlaps between climate change vulnerability and poverty, but also the trade-offs, given the context of multiple shocks and stresses poor people navigate in pursuing their livelihoods.

Asset-based and livelihoods approaches to exploring climate change vulnerability on the ground provide a valuable guide to understanding the role of different kinds of assets in coping and adaptation, however they tend to focus overwhelmingly on tangible resources (e.g. financial, technological assets), where this research goes beyond such resources to explore additional factors that also shape vulnerability and adaptation, in particular, the role of the 'normative and motivational context' (Haddad, 2005) for adaptation. Here, insights from emerging literature and frameworks for exploring adaptive capacity at the sub-national level (across communities, households, and individuals) using indicators such as perceptions of risk, and attachment to occupation (Marshall et al., 2010) (Section 2.5.6) prove particularly relevant. These kinds of approaches that address different scales are central to the Mediating Factors Framework, in particular for exploring differentiation, not only across households, communities or groups (e.g. day labourers, fishermen, women) but also among individuals within these wider groups, thus allowing for a more nuanced appreciation of differentiation in vulnerability and adaptive capacity (Section 2.7).

Chapter 3:
Methodology and fieldwork approach

3.1. Introduction

This chapter reviews the methodological approach undertaken in the fieldwork for this research, including: field site selection (Section 3.2); main research questions and fieldwork approach (Section 3.3); the three main phases of data collection in the field (Section 3.4); practical and ethical considerations (Section 3.5); and approach to data analysis (Section 3.6).

3.2. Field site selection

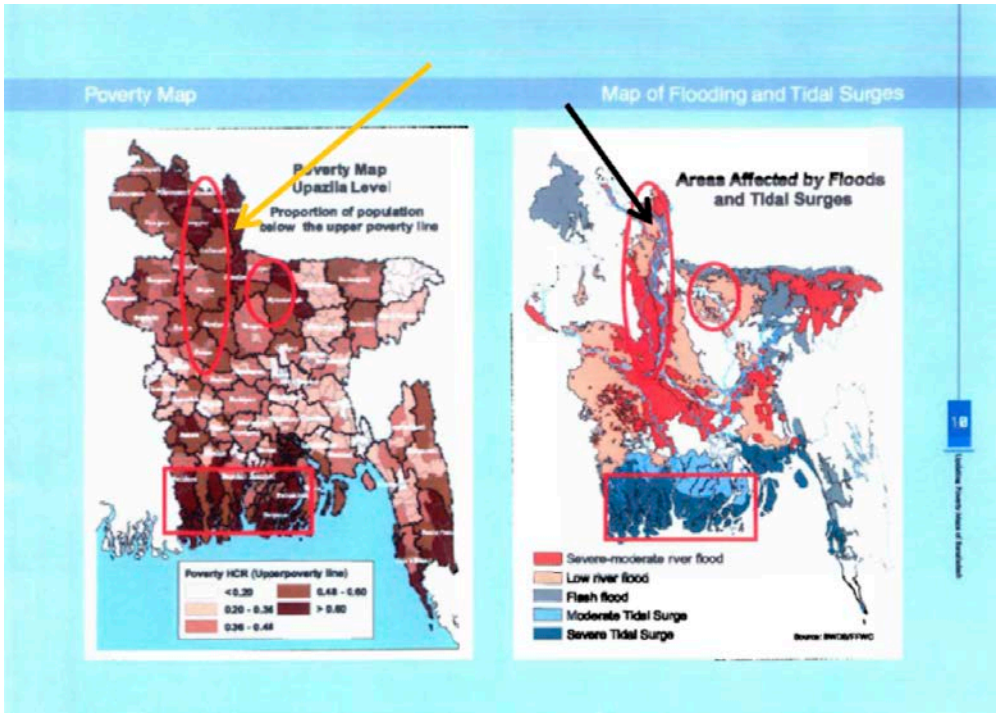
Fieldwork took place in Northwest Bangladesh, in Gaibandha District within the newly formed Rangpur Division.[7] Preliminary findings from the 2008 Agricultural Census, which surveyed all households in the country, indicates that 93.9 per cent of households in Rajshahi[8] are rural; it has both the largest number of agricultural households and the largest number of landless households after Dhaka (BBS, 2008). The 2010 HIES (BBS, 2011b) finds that Rangpur has the highest incidence of overall and rural poverty of all Divisions in Bangladesh, using both the upper and lower poverty lines. The area is susceptible to severe alternating floods and droughts, riverbank erosion, and cold waves. The total population of the Rangpur Division is 16.4 million (BBS, 2011a), in 4,581 villages averaging 200-400 households each. Literacy rates average between 33 and 42 per cent, dropping as low as 25 per cent in some villages in 2005 (World Bank et al., 2009). The average rose to 47.5 per cent in the 2011 Census, again with great variation across areas within the District (BBS, 2011a). Given the characteristics of the area (extreme poverty, chronic food insecurity, vulnerability to climate variability and disasters), most major international and domestic and NGOs (e.g. CARE, Practical Action, BRAC) have some presence in Rangpur.

[7] Until recently, Rajshahi Division encompassed the entire Northwest region of Bangladesh. However, in January 2010, eight Districts in Rajshahi were separated into a new, seventh Division known as Rangpur. Fieldwork was underway in Gaibandha, one of the eight Districts that now comprise the new Rangpur Division when this administrative change took place.

[8] Since many background studies and statistics undertaken before early 2010 present data on Gaibandha as a part of Rajshahi Division, this thesis also refers to the larger Rajshahi Division, and selectively presents data on the new Rangpur Divison when available.

Map 1 provides a graphic presentation of the distribution of poverty by *upazila* (using upper and poverty lines drawn from the 2005 HIES), and the areas of Bangladesh most affected by climate related disasters i.e., floods and tidal surge; the two converge in three main locations in the country, including the part of the Northwest where fieldwork was undertaken.

Map 1: Overlap of poverty and areas affected by floods and storm surges

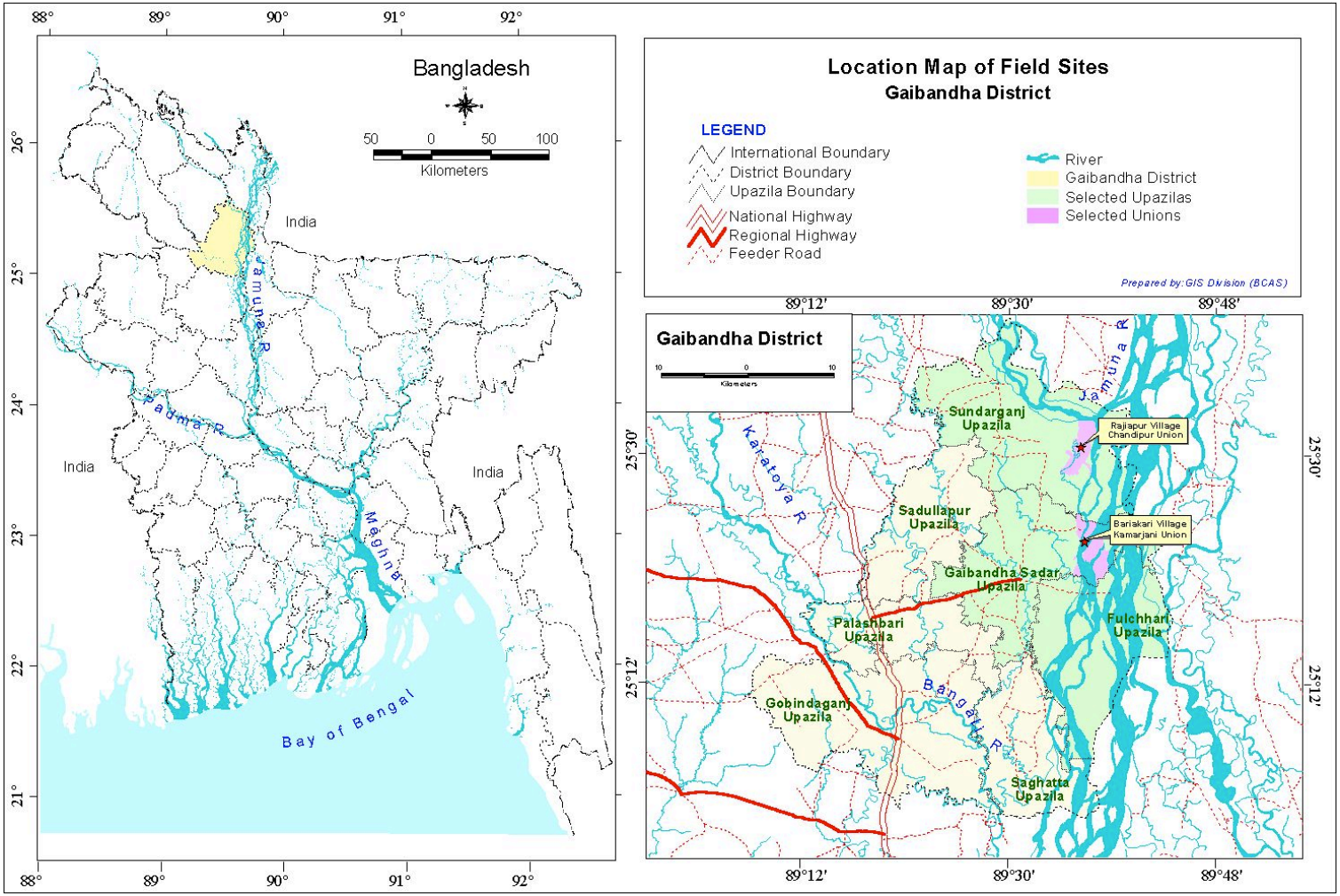


(Source: World Bank et al., 2009: 10)

During the first two months in Bangladesh, various scoping trips were conducted, and scoping interviews held with national and local level experts, including NGO staff working on issues of climate change, poverty, and livelihoods, from: Bangladesh Centre for Advanced Studies (BCAS), CARE, Gana Unnayan Kendra (GUK), Udayan Swabolombee Sangstha (USS), CARITAS, Practical Action, Rangpur Dinajpur Rural Service (RDRS), and Social Development Fund (SDF)). The scoping trips were used to select specific villages for fieldwork, and entailed travel to Gopalganj, Chapai Nawabganj, and Gaibandha Districts.[9] Between six and eight hours was spent in each village visited, undertaking FGDs and visiting individual homes to speak with local people. Following these scoping trips, Gaibandha District was selected. Fieldwork was concentrated in two villages in Gaibandha District, shown below on Map 2: (1) Rajiapur Village, in an embankment area in Chandipur Union, Sundarganj *Upazila*; and (2) Bariakari Village, located on a riverine *char* in Kamarjani Union, Gaibandha Sadar *Upazila*.

[9] A project area of BCAS and local partners in Satkhira District was also visited on a previous trip to Bangladesh, to attend the Community Based Adaptation Conference (CBA) based in Dhaka in February 2009.

Map 2: Location of field sites in Gaibandha District



(Prepared by BCAS, GIS Divisio

These specific villages were selected according to the following criteria:

(1) Research contribution – villages that had not been the object of prior research on climate change and poverty and therefore fieldwork would contribute to knowledge about them
(2) Heavy concentration of extremely poor households
(3) Variation of livelihood activities (e.g. small farmers, day labourers, fishermen)
(4) Range in degree of biophysical exposure across households (i.e. location and quality of land holding or homestead)
(5) Medium-sized villages (between 100 and 300 households)

Fieldwork was supported at the national level by BCAS, and in Gaibandha by GUK, a local partner of BCAS. These institutions were generous in providing guidance and logistical support, from arranging the initial scoping visits to various locations around the country, to engaging in discussions and providing invaluable feedback and insights on the research, fieldwork approach, and findings. Following the completion of fieldwork in September 2010, a seminar was organized by GUK where results from fieldwork were presented and discussed at length with members of local NGOs, and local government. This day-long seminar provided an excellent opportunity to report and gain feedback and insight from individuals working on and thinking about local poverty and climate-related issues in the field site areas.

Regarding the availability of secondary data, the major national source of statistics on poverty is the Bangladesh Bureau of Statistics (BBS), that produces a Population and Housing Census every 10 years (latest 2011), a Household Income and Expenditure Survey every five years (latest 2010), Labour Force Surveys (latest 2010), and Agricultural Censuses (latest 2008). Most of these provide data only to the Division level; the population Censuses provide detail to the Union level; and a poverty mapping exercise (World Bank et al, 2009) used the 2005 HIES database for analysis to the District level. The main national sources of data on climate-related matters are the Climate Change Cell (CCC) of the Ministry of Environment and Forests (MoEF) and the Bangladesh Meteorological Department (BMD). International agencies that support research using these data sources, sometimes supplemented by complementary studies, include the UNDP, FAO, UNICEF, IFPRI, World Bank, and Asian Development Bank.

In general, literature on Gaibandha is scarce; even fewer sources are available at the local level (*upazila* and Union), and virtually none at the village level. However, there have been a number of other research and study efforts by NGOs, aid agencies, and academics that have generated findings on livelihoods in the Northwest region, for example: CARE Northwest Livelihoods Surveys; World Food Programme (WFP) Vulnerability Mapping; and project site reports from BCAS, GUK, CARE, the DFID *Chars* Livelihood Programme (CLP), Practical Action, RDRS,

and BRAC. This literature was helpful for analysis of the broader context in the Northwest region, and anchoring primary data from field sites.

3.3. Research questions and fieldwork approach

Guiding research questions: *What is the nature of vulnerability to climate change impacts among extremely poor households and individuals? What are local perceptions among extremely poor people about climate and non-climate related risks, and livelihood coping and adaptation needs and constraints?* In particular, how are climate shocks and stresses affecting the various social and livelihoods groups that make up the 'extreme poor'? How do climate-related shocks and stresses fit within the wider risk and vulnerability context? What are local perceptions of climate change, and what indigenous autonomous, and intervention-based coping and adaptation activities are already taking place, if any, at the community and household levels? Where do gaps and needs exist with respect to future adaptation?

Main hypotheses: *(1) Climate change is altering the pre-existing vulnerability context for extremely poor communities in the field site areas. (2) Climate change vulnerability is differentiated among extremely poor households and individuals. (3) Several 'mediating factors' affect this differentiation and influence local coping and adaptive responses.* Communities in Bangladesh perceive changes on the ground in climate, including increased variability of extreme events and seasonal weather patterns. These changes may be affecting the wider context of multiple stressors in which extremely poor communities confront the effects of shocks and stresses, climate-related or otherwise, and thus are affecting local livelihoods in wide-ranging, albeit undocumented, ways that may be differentiated. The extreme poor are heterogeneous, may experience climate impacts in different ways, respond differently to them, and may therefore have different needs with respect to climate change adaptation.

Fieldwork approach: To explore climate change vulnerability: (1) from the perspective of local people characterised as 'most vulnerable' to the impacts of climate change; (2) at a disaggregated level to explore differences across and within households and community; and (3) as a dynamic process, in the context of multiple other sources of risk and vulnerability.

Towards this end, this research uses a combination of secondary (documentary/literature-based review) and primary data collection methods, the latter based on a qualitative approach. In line with Chambers' (1997: 115) distinction between Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA), the former referring to a family of data collection

methods, and the latter to an 'on-going empowering process,' the nature of data collection is more closely aligned with RRA (e.g. semi-structured interviews, FGDs). Some participatory methods are used (e.g. CVCA activities, Section 3.4.1), and a semi-structured approach to household and life history interviews is followed as a way to understand the perspectives and motivations of local people, considered as the real 'experts' on climate vulnerability and adaptation in their communities. In this way, the approach is participatory (Loizos and Pratt, 1992), at various points involves 'handing over the stick' (Chambers, 1997), and throughout prioritizes local people's knowledge and experience. However, while the central focus is on respondent perceptions, and research findings were shared with local NGOs and development agencies in Gaibandha District, in hopes that findings would feed into their strategic operations, this research cannot be classified as an 'on-going empowering process' (Chambers, 1997: 115).

3.4. Methodology: three phases of data collection

Research methods reflect the translation of research questions into fieldwork questions. For this research, this was achieved by breaking down the questions and hypotheses presented in Section 3.3 above into sets of sub-questions, drawing from literature reviewed in Chapter 2. These questions aimed to cover the following topics:

(1) Household resources
(2) Biophysical exposure and sensitivity of household resources and livelihoods to impacts from climate and non-climate-related shocks and stresses
(3) Coping strategies undertaken in response to climate and non climate-related shocks and stresses, such as flooding and riverbank erosion (with a focus on patterns of differentiation in the household breakdown of roles and responsibilities for undertaking different coping activities)
(4) 'Mediating factors' – local social/political/cultural context; factors and processes shaping beliefs, motivations, and perceptions about climate change
(5) Livelihood outcomes, assessed in terms of vulnerability to shocks and stresses in the present and perceptions about future vulnerability, and in relation to well-being, assessed in terms of tangible and intangible resources identified and prioritised by local households

Questions around these core topics guided data collection during all phases of fieldwork, which was divided into three discrete and sequential phases, each corresponding to increasingly lower levels of analysis; (1) community;[10] (2) household;[11] (3) individual. The approach taken

[10] 'Community' is used here to mean some definable aggregation of households, interconnected in some way, and with a limited spatial extent, analogous to Coombes et al.'s (1988, cited in Smit and Wandel, 2006: 283) use of the term 'locality'. In neither of the two main fieldwork sites did the community correspond to the administrative village unit, as the latter in Bangladesh tends to be much larger than a community as envisioned in this definition. Given the centrality of exploring community dynamics and the ways in which relations among households and families may affect livelihood vulnerability and

throughout all phases has been ethnographic, with an overarching aim to explore—from the perspective of local community members—livelihoods, resources, climate-related sources of risk and vulnerability (e.g. floods, drought, riverbank erosion), coping and adaptive strategies, and the factors and processes characteristic of the wider local context (including for instance, social and power relations and local institutions), that mediate coping and adaptive response. The sub-sections below describe the specific methods used during the three main phases of fieldwork.

In addition to the methods described in sub-sections below, key informant interviews, additional FGDs, informal chats with individuals and groups in the fieldwork locations, and participant observation took place throughout all three phases (described in Section 3.4.4 on cross-phase methods). These were used to probe further issues that arose during formal data collection and seemed to be important.

3.4.1. Phase one: CVCA

The initial phase of fieldwork comprised village-level, climate-focused PRA activities drawn from the Climate Vulnerability and Capacity Analysis (CVCA) methodology (Dazé et al., 2009). These activities were undertaken with communities in what became the two main fieldwork sites—Rajiapur and Bariakari, as well as in a third site, in Ratanpur Village (Uria Union, Fulchhari *Upazila*). Three sites were included in the CVCA phase in order to provide a wider set of locations to compare, and from which to select, for inclusion in subsequent phases of fieldwork. The CVCA approach combines perspectives and methods from rural livelihood analysis with disaster risk reduction (DRR)-based climate-related risk analysis tools, in a set of PRA methods used to assess the livelihood vulnerability of rural communities (Dazé et al., 2009). Specific CVCA activities include:[12] (1) transect walks, (2) community/hazard mapping,[13] (3) historical timeline, (4) Venn diagram (institutional mapping), (5) vulnerability matrix (including both climate and non-climate related risks), and (5) seasonal calendar.[14] Data gathered from CVCA activities were used to generate community profiles for each of the field sites (presented in Sections 5.2.1 and 5.2.2, Chapter 5), which supplemented existing District,

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coping practices in the fieldwork sites, discrete sections of the wider Bariakari and Rajiapur villages were selected—usually a set number of *paras*, i.e. neighbourhood, or hamlet (Orr et al., 2009) within the village, where a singular and coherent community could be identified. Other researchers undertaking research in rural Bangladesh have followed this methodology (e.g. Bode, 2002) as *mouza* and village lines are often meaningless in terms of defining community boundaries; they may contain many communities and/or cut across community lines.

[11] 'Household' here refers to a unit or collection of individuals who share labour and other inputs and consume food together under one roof (Blaikie et al., 1994: 49).

[12] See Appendix 1 for a more detailed description of these methods.

[13] See Maps 8 and 10, Chapter 5, for community maps of Rajiapur and Bariakari, respectively.

[14] See Figure 7, Chapter 5 for seasonal calendar created by Rajiapur community members.

Upazila, and Union level data and statistics (Section 4.5, Chapter 4), and any available village level data or literature (e.g. GUK, BCAS, and CLP project reports) available on the local area. In addition to developing an overview of the field site context, the community profiles provided a basis from which to select specific households and individuals for more in-depth life history and semi-structured interviews.

All CVCA phase activities were conducted in FGDs (Beazley and Ennew, 2006). Most of the CVCA phase FGDs included the drawing of illustrations to represent the topic of conversation. FGDs that did not include drawing were undertaken mostly to probe specific topics (e.g. flood coping, local moneylenders) and took place throughout all phases of fieldwork. For all FGDs, the aim was to include between 10 and 15, and no more than 20 people, usually representing a mix of social, livelihood, and wealth groups, to the extent possible. Some FGDs were held with specific groups of people, for example women, to discuss subjects such as the ways in which flooding affects them particularly and their role in undertaking household coping activities (Pratt and Loizos, 1992: 66-74). This was done to create a space for women to speak more freely about effects such as the need to wait until nightfall for privacy in performing bathroom activities, given the flooding of latrines. In retrospect, however, the topics women discussed amongst other women did not vary much from those they felt comfortable discussing with men present.

For this research, participatory wealth-ranking activities (Chambers, 1997; Chambers, 1994; Orr et al., 2009; Beazley and Ennew, 2006; Narayan et al., 1999) were added to the above CVCA methods. These were used to understand the socio-economic breakdown in each of the three initial fieldwork communities, exploring in-depth what it means to be rich, or poor in local terms, and to provide an initial identification of extremely poor households in each field site. This approach allowed respondents to identify for themselves the socio-economic groups in their villages, and opened space for discussion of the more intangible, subjective elements of wealth and poverty that are largely missed by income and consumption-focused methods. Wealth-ranking activities were undertaken with groups comprised of individuals from all socio-economic categories in each fieldwork village.[15]

The results of the wealth-ranking in the two sites ultimately selected for further fieldwork are shown in Table 1:

[15] See Figure 4, Chapter 5 for the participatory wealth-ranking diagram made by community members in Rajiapur.

Table 1: Results of participatory wealth ranking at field sites

		Poverty				
Field site	**Total households**	**Beggar**	**Extreme poor**	**Poor**	**Middle class**	**Rich**
Rajiapur	**250**	20	130	80	10	10
Bariakari	**145**	12	74	40	12	7

Data on what it means to be rich and/or middle class in the field sites were gathered primarily during the participatory wealth-ranking, since these exercises included individuals from all socio-economic groups, including middle class and rich individuals. However, the characteristics and experience of being extremely poor, initially identified during participatory wealth-ranking exercises, were then further elaborated during household and life history interviews with individuals from the extremely poor core respondent group.

The data collected during the CVCA phase of fieldwork were used to generate baseline information and create profiles for the three initial fieldwork communities, from which two main fieldwork sites were selected. Across the two main fieldwork sites (Rajiapur and Bariakari), a group of 41 households (163 individuals) matching the criteria for extremely poor households identified during participatory wealth-ranking activities were then selected to make up the core respondent group. These individuals participated in the more in-depth household and life history interviews comprising phases two and three of data collection, respectively.

3.4.2. Phase two: household interviews

Participatory wealth-ranking carried out during the CVCA phase was used in conjunction with interviews with NGO staff and development workers in the area to determine locally relevant criteria for extreme poverty. The criteria identified with respondent groups broadly matched those used by local NGO and development staff (DFID-CLP, BRAC, GUK) to select beneficiaries for anti-poverty programmes in the local area, and were instrumental in identifying respondent households for phases two and three.

Variations in livelihood activities began to emerge among extremely poor participants during the CVCA phase, and these patterns also guided respondent selection, in order to ensure an appropriate range of local livelihoods would be reflected in the composition of the sample group. The predominant livelihood activities for extremely poor households included:

agriculture (agricultural day labour, sharecropping, and farming on own or claimed land); river-based work (boatmen and fishermen); migration; begging; business; construction; housework; livestock (the rearing of animals that are owned, rather than shared); sharecattling (rearing of animals that are shared rather than owned); maid servant work; rickshaw and van pulling.

The selection process aimed to achieve representation of each of these main livelihood groups in the respondent sample, although it soon became clear that most extremely poor individuals in the field sites switch livelihood activities throughout the year, as different income-earning opportunities become available.[16] However, regardless of engagement in various livelihood activities, individuals in both fieldwork sites self-identified with one main livelihood activity over others, and the respondent selection process was guided by this self-identification. Social variations were also represented in the respondent sample, including, for instance: female-headed households, single person households (often older women, widows), those including chronically sick and disabled individuals, those with and without children, and with children of different ages.

The Rajiapur fieldwork community comprises a total of about 250 households, and just over 10 per cent, or 26 households, were selected for inclusion in the core respondent group. In order to explore various facets of differentiation, households from both the Hindu and Muslim *Paras* (neighbourhoods) were included in the sample and individuals selected gave coverage to all livelihood activities undertaken by extremely poor respondents in Rajiapur. The same respondent selection process was followed in the Bariakari fieldwork site, where 15 extremely poor households out of a total of 145 on the *char* at that time were included in the core respondent group.

Data were collected for all members of each respondent household, and as many household members as were willing to participate from each household were interviewed, including children. This was useful in capturing elements of intra-household differentiation in relation to vulnerability, perceptions of change in climate, responsibilities for undertaking household coping, and so on. Across both field sites, data were collected on a total of 163 household members, and 92 of these individuals were interviewed, from the total pool of 41 respondent households. In Rajiapur, data were collected on all 104 members of the 26 respondent households, and 56 of these individuals were interviewed. In Bariakari, data were collected on all 59 members of the 15 respondent households, and 36 of the individuals were interviewed.

[16] This will be further elaborated in Chapter 5, Section 5.4 on livelihood activities.

Table 2: Summary of respondents

	Total	Interviewed	Not interviewed
Rajiapur			
Children (0-14)	42	10	32
Adults (15+)	62	46	16
Rajiapur Total	**104**	**56**	**48**
Bariakari			
Children (0 to 14)	23	10	13
Adults (15+)	36	26	10
Bariakari Total	**59**	**36**	**23**
Total	**163**	**92**	**71**

It was necessary to conduct most interviews over the course of between one and three visits. This often provided an opportunity to interact with different household members both individually and in groups. During initial interviews, each respondent household was asked to self-identify with one of the categories identified during the participatory wealth-ranking activity for their village (rich, middle, poor, extreme poor, beggar).[17] The results of this self-identification are shown in Table 3.

Table 3: Poverty breakdown of respondent group - results of HH self-identification

		Poverty				
Field site	Total respondent households	Beggar	Extreme poor	Poor	Middle class	Rich
Rajiapur	26	6	11	8	1	0
Bariakari	15	2	4	9	0	0
Total	**41**	**8**	**15**	**17**	**1**	**0**

Self-identification and peer identification (the latter from participatory wealth-ranking activities, results shown above in Table 1) overlap for only 23 out of 41 households, with 18 respondent

[17] These categories are introduced in greater detail in Chapter 5, Section 5.3.

households identifying themselves as belonging to socio-economic groups other than the 'extremely poor' (17 of these households self-identified as 'poor' and one as 'middle class'). There are two important points to make about this: First, in the criteria for extremely poor households (and for all socio-economic categories) that were identified during the participatory wealth-ranking exercises, there exists a range in terms of resource ownership with some households falling nearer to the top end of the range, and others nearer the bottom. The 17 households self-identifying as poor tend to fall nearer to the top end of this range, and would still be considered extremely poor by the extremely poor group criteria identified during participatory wealth ranking.

Secondly, there seems to be a pattern whereby respondents take some time to adjust to a drastic change in socio-economic conditions, and therefore are reluctant to self-identify as extremely poor right away, which may be the case for the one household that self-identified as middle class. While this household would be considered extremely poor based on participatory wealth-ranking criteria, it had very recently experienced significant and rapid impoverishment due to loss of a great deal of land to erosion.

The livelihoods framework guided the development of the household interview questionnaire, which was loosely followed during semi-structured interviews. Six categories of questions were covered in each interview: basic information (age, marital status, religion, household members); resources (beginning with resources identified as critical by respondents, rather than covering the traditional categories of capitals); livelihood activities; social networks, relationships, community dynamics and norms; access to government and NGO services; shocks, stresses, and risks, both climate and non-climate related; coping and weather prediction methods; and perceptions of climatic change. The data collected during household interviews were used to create household profiles that, in turn, were used to select individuals with whom it would be fruitful to conduct life history during phase three of fieldwork.

3.4.3. Phase three: life histories

For the life history phase of data collection, 10 individuals from across the 41 respondent households were selected—four from Bariakari and six from Rajiapur—representing both a distinct livelihood group,[18] and a mix of social groups. The life history method was used to elicit more in-depth views of respondents about the dynamics of vulnerability over time. In particular,

[18] As with the household interviews, respondents' self-identification with a main livelihood activity guided this selection process.

"… patterns of cumulative causation emerge and individual episodes of crisis, coping and opportunity can be seen within the interrelated and wider context of national, community and family trajectories... On the coping side, [life history interviews] have allowed patterns to emerge of diminishing or accumulating resources and allows repeated behaviour patterns to be seen" (Davis, 2006: 2).

Life histories have been critical in this research for exploring how vulnerability has changed over the lifetime of respondents, including, for instance, perceived changes in exposure to shocks and stresses, in access to resources for coping, in the livelihoods pursued, and in coping strategies; whether/how respective roles of household members in pursuing livelihoods strategies have changed across different cycles in the life of the household (e.g. child birth, old age), as well as changes in the wider socio-political context or shifts in cultural norms (for instance, women working out of the household).

The evolution of household coping strategies over time was also of central focus during life history interviews thus placing analytical emphasis on the activities, agency, and ingenuity respondents exhibit in responding to the effects of shocks and stresses. This approach "challenges the assumption that poor people are passive, followers, or apolitical, by identifying ways in which people are makers of their own history" (Beck, 1989: 23), reflecting the anthropological, participatory approach taken to this fieldwork, in which respondents, their perceptions, and the livelihood and coping strategies they employ, are of central importance.

The method used for life history interviews follows from Davis (2006, 2007) and Pratt and Loizos (1992). It involves developing a participatory chronological template of significant events (e.g. the Independence war of 1971; famine in 1974; floods in 1988 and 1998; Cyclone Sidr in 2007) both in national and local history, the latter drawn from information gathered during historical timeline activities during the CVCA phase. This template provided a set of benchmarks that helped to accurately situate in time events in the lives of respondents. During pilot life histories, the technique of drawing a map with each respondent to illustrate trends was tested. However, this proved to be more confusing than helpful, and as an alternative for rating the relative severity of impacts on respondent poverty levels from different shocks, between one and three + signs were used to indicate severity, in order to compare across different events (this was the same system used to rate severity of shocks and stresses during the vulnerability matrix exercises in the CVCA phase of data collection).

Each life history interview lasted between two and four hours, and provided an opportunity to explore the climate-related vulnerability trajectory over the respondent's lifetime. The

individuals participating in these interviews had already been met and interviewed on several previous occasions, during household interviews and CVCA activities. The 10 life histories were grouped based on trajectory patterns observed across respondents' lives (Davis, 2006). This was done by grouping individuals according to whether their poverty trajectory, or trend in life condition (*obosta*) was declining, level, or improving. Particular attention was paid in life history interviews to climate-related drivers poverty and vulnerability. Davis (2006) further categorizes trajectories according to temporal dimensions, i.e. distinguishing between the immediate/present or short-term trajectory, and trajectory patterns observed over longer time periods. This temporal dimension is particularly relevant to this research, for exploring differences between short term/seasonal shocks and stresses and longer-term trends of change in life condition (*obosta*), the role of climate and non climate-related shocks and stresses in these dynamics, and response activities through time.

3.4.4. Cross-phase methods

In addition to semi-structured interviews with the core respondent group, informal chats, FGDs, and additional key informant interviews were held with other community members not in the core respondent group, including, for instance, local leaders, police officers, current and ex-Union Parishad members, shop owners, and individuals visiting from other villages, usually extended family members. These were carried out in both fieldwork sites, across all three phases of data collection.

Key informant interviews (David and Sutton, 2004; Dazé et al., 2009) were also conducted with local and national level experts, researchers, local NGO staff and development workers throughout all phases of research. These were used to explore specific topics at different points in time, for example during preliminary phases of fieldwork, key informant interviews were held to gain information about the extreme poverty—climate context and linkages, in Bangladesh generally and specifically in Gaibandha, to identify potential field site locations and to obtain views on the feasibility/suitability of the proposed research approach. In subsequent phases of fieldwork, key informant interviews were used as and when needed to learn more about specific topics, for example the role of government safety nets (SSNs) in supporting coping with floods for extremely poor people in field site locations.

Finally, participant observation was used through all phases of fieldwork. This entailed attendance at and observation of village life on 'normal' days, as well as during religious/cultural festivals and other important events (Brockington and Sullivan, 2003: 65-68; Dewalt et al., 1998: 259-301).

3.5. Practical and ethical considerations

Fieldwork was supported at the national level by the Bangladesh Centre for Advanced Studies (BCAS), in collaboration with IDS, and at the local level by Gana Unnayan Kendra (GUK), a Gaibandha-based partner of BCAS. Prior to fieldwork, two weeks had been spent in Bangladesh, part of which was spent attending the Community Based Adaptation (CBA) Conference in Dhaka during February 2009. This also involved a field visit to the Satkhira District in the southwest of the country to the previous site of the Reducing Vulnerability to Climate Change CBA project, which had been run by CARE Bangladesh until 2003 when the project was discontinued due to loss of funding (however many of the activities initiated by the project had been taken up by the local community and still constituted important adaptive practices).

This trip to Bangladesh was invaluable in that it afforded an opportunity to establish contacts with a number of key stakeholders in the poverty, vulnerability, and climate change fields, including at BCAS, GUK, CARE Bangladesh, the Bangladesh Disaster Preparedness Centre (BDPC), BRAC Development Institute (BDI), UN World Food Programme (WFP), the World Bank Dhaka office, Comprehensive Disaster Management Programme (CDMP), and the Climate Change Cell (CCC) of the Government of Bangladesh.

Connections with BCAS and GUK proved critical in terms of logistical support for fieldwork, including a place to live in Gaibandha (GUK guesthouse), guidance and advice about field site selection and fieldwork approach, as well as exchanges about findings as they were emerging. This not only provided much-needed local, practical, and intellectual support for the research, but afforded an opportunity to work closely with local climate change and development/poverty-reduction oriented NGOs. Findings from this research may potentially feed into their programmatic approaches, contributing to a better understanding of poverty—climate—livelihood linkages, at a disaggregated level, and from the perspective of extremely poor vulnerable people themselves. A purpose of this research has also been to contribute, in any way possible, to making the livelihoods of my research respondents more secure in a direct and tangible way. Sharing information and having frequent exchanges about findings of fieldwork with individuals implementing livelihoods programmes in the field site areas hopefully contributed towards this end.

That said, associations with NGOs influenced local perceptions of my identity, as an outsider, a Western female researcher and any possible intentions or potential benefits associated with my work. The issue of positionality, and identity-based bias, and ways to correct for it through fieldwork methods, was considered throughout research design and data collection. In addition, language barriers presented a constraint. While intensive language training in Bangla was undertaken during the initial three months in Bangladesh, and comprehension and speaking ability improved throughout the course of fieldwork, I did not possess sufficient fluency to conduct interviews without translators. Three individuals were employed at different points throughout the fieldwork, translating during interviews and subsequently transcribing interviews, which had been voice recorded, in English. These were all recently graduated masters and undergraduate students, two males and one female, all in their early twenties, Bangladeshi, and fluent in English. While none of the translators had been to Gaibandha before, having the insight of young Bangladeshis provided another perspective on conditions in the field sites, and, for instance, around social and cultural norms. At the same time, ensuring that their perspectives did not influence the way questions were put to respondents, or answers translated, was a continuing challenge. It became easier to manage as my fluency improved sufficiently to gauge the flow of conversations; this was particularly helpful at the stage of the life history interviews. Support was also obtained from BCAS and GUK in working through the most appropriate terms to use to avoid introducing bias into questions and responses, and considerable time was spent discussing findings with translators shortly after FGDs and household interviews to identify whether there could be any subtle differences in interpretation of what had transpired.

Probing intra-household dynamics and intra-community power relations also raises sensitive issues for respondents, and in line with ethical considerations, steps were taken to ensure that they were not exposed to harm as a result (Bryman, 2001; Pratt and Loizos, 1992; Scheyvens and Storey, 2003). Furthermore, the ways in which power relations between researcher and respondents, and among respondents themselves, may influence data collection (ibid.) were considered in research design, through selection of the participatory, ethnographic approach undertaken. This acted to counter biases that may stem from background, identity, and education of researcher and translators, to avoid their shaping the research plan. Questions across all phases of data collection and all methods were designed to be open ended, allowing respondents to define the specific contents of discussions. For instance, instead of basing data collection around pre-defined lists of ‘capitals’, or ‘policies, processes and institutions’, fieldwork began by allowing respondents to define for themselves the set of livelihood resources that were important to them, and the processes and factors that mediate their ability to

cope with shocks and stresses in turning their resource bases into livelihoods. This helped to counteract the influences of outsider bias on the research.

Since most respondents depend on daily wages, and hours spent participating in interviews interfered with work, they were financially compensated for their time. It was not feasible for most respondents to forgo a day's income, and it would have been unethical to expect them to do so. Payments were equal to the amount respondents would have earned for a day's labour (usually between 100 and 120 *taka*, i.e. $1.32 – $1.59). Whether or not to compensate respondents was considered at great length and discussed with local NGO workers. Particular thought was given to what would be locally acceptable and appropriate ways of addressing this issue, including the level of compensation. Research activities were planned according to the availability of respondents, bearing in mind particular time restraints on households, such as labour seasonality (Pratt and Loizos, 1992; Scheyvens and Storey, 2003). To ensure compensation did not distort the sample, all respondent households were selected at the outset of phase two, before compensation was offered.

The principle of informed consent was also observed in fieldwork methods, ensuring that the nature and purpose of research was fully and clearly explained (in oral or written form, as appropriate) to respondents (Fluehr-Lobban, 1998). Wishes not to participate in fieldwork were respected, as were concerns about confidentiality. To protect the identity of respondents, names of individuals and of the two main field sites have been changed. Translators were also trained to ensure they understood the objectives of the research, and how specific methods of data collection related to those ends. Translators were also made fully aware of the various ethical considerations involved in undertaking this research. Finally, respondents were periodically briefed on the evolution of my research, and prompted to provide feedback on their perceptions of the findings, which were also made fully available to BCAS and GUK, and other stakeholders such as members of local government, and other NGOs and development agencies working in the area.

3.6. Data analysis

Content analysis was used to analyse fieldwork data. This included both manual and computer (using Nvivo) coding of interview notebooks and interview transcriptions. Excel was also used to organize and enumerate data on resources, livelihood activities, and perceptions of climate and non climate-related hazards, including changes in climate over time. Nvivo was used particularly during earlier phases of data analysis as a way to quickly generate a large number of

nodes, as ideas were developing around how to group data. Once all data were arranged into almost one hundred nodes, patterns began to emerge that allowed for grouping into a much smaller number of trees of nodes, each representing a wider topic under which several strands of relevant information were then grouped (Bazeley, 2007). This allowed for breadth of information, characterised by snippets of interview excerpts about specific topics.

While convenient for identifying patterns across the dataset, organising data in Nvivo and Excel tended to divorce much of its meaning from the context of the interviews and FGDs in which individual statements were made. The data are qualitative, and while quantitative analysis of some aspects of the dataset has been useful for comparing across respondents, more in-depth content analysis was required to fully capture the richness of the data. Therefore, a final round of coding involved a return to fieldwork notebooks and interview transcriptions, in order to flesh out some of the patterns identified with Nvivo and Excel. This was achieved through, for instance, connecting opinions and perceptions reflected in the Nvivo codes and Excel spread sheets to the identity of respondents holding them. In this way, patterns of differentiation emerged among different kinds of respondents, for instance those dependent on river-based wage labour vs. those working primarily in agriculture, and between different social groups, such as respondents with health problems, men, and women. Nuances also emerged between individual respondents within the same general group.

The Mediating Factors Framework guided analysis of the processes and factors underlying patterns of differentiation. The mediating factors that emerged as relevant for extremely poor respondents in Rajiapur and Bariakari include: health and physical capability, community/family networks, political ties and corruption, information about climate and weather, and perceptions of climate change and beliefs about its causes. The ways these relate to coping with climate-related shocks and stresses are described in detail in Chapter 7.

3.7. Conclusions

This chapter details the approach taken to methodology and fieldwork. A qualitative research design and ethnographic approach to fieldwork was undertaken, informed by the conceptual framework described in Chapter 2 (Section 2.7). The Mediating Factors Framework was designed to place central focus on the perceptions and views of respondents themselves, and to analyse the factors that mediate differentiation across respondents (Chapter 2, Section 2.7.3). The fieldwork approach that followed was therefore based around methods designed specifically to explore vulnerability from the perspective of local people, at progressively disaggregated levels, and as a dynamic process, in the context of various other sources of risk

and vulnerability in the lives of local people. These aims were achieved through the use of participatory—albeit not empowerment-focused—methods (e.g. CVCA), carried out at the individual, household, and community levels, with a sustained focus throughout on respondent perceptions of change through time.

The aim of capturing the dynamic nature of vulnerability was achieved through use of methods designed to elicit respondent's views of change through time throughout each phase of fieldwork. Certain methods were principally focused on change and the dynamic nature of vulnerability across different seasons, or the lives of respondents, including, for instance, historical timelines and seasonal calendars during the CVCA phase, and life history interviews. However, questions about change through time were included in all FGDs and household interviews, across most categories of questions (See Section 3.4; 3.4.2 for categories of questions).

The progression throughout fieldwork of increasingly lower levels of analysis was critical for exploring differentiation, both that relating to membership in groups, such as different livelihood and social groups, but also differentiation that operates at the level of individuals within those groupings. It was important to sequence the phases of fieldwork to move from community to household to individual levels in order to develop an understanding of the household context, within the wider community context that had been explored in the preceding phase, and then to place individual perceptions and life histories within those wider contexts. This approach relates directly to a 'starting point' (O'Brien et al., 2007) understanding of vulnerability, which highlights the role of contextual factors underpinning differentiated vulnerability across respondents (Chapter 2, Section 2.7.3). The following chapter begins this context setting approach by exploring the national, regional, and District level contexts for this research.

Chapter 4:
Bangladesh, Rajshahi-Rangpur, and fieldwork areas in Gaibandha District

4.1. Introduction

This chapter introduces the national context of Bangladesh, with a focus on the Northwest region and local areas in which the fieldwork took place. It analyses relevant demographic, geographic, and socio-economic data on economic growth, development, and poverty reduction in recent decades, with a focus on extreme rural poverty. It also reviews data on past climate trends, the state of knowledge on future climate projections, and how these may affect the livelihoods of extremely poor rural communities. This provides critical background for subsequent chapters that explore drivers of vulnerability in the two fieldwork villages and the ways in which climate, and locally perceived changes in climate, are affecting the livelihoods and coping strategies of extremely poor households and individuals.

4.2. Bangladesh: overview

Bangladesh is a South Asian country on the Bay of Bengal, bordering India and Myanmar.[19] Most of its 147,570 sq. km are low-lying floodplains situated in one of the world's largest deltas, with a network of about 200 rivers, including 57 that have origins in other countries (CCC, 2009a: ix). The three largest rivers are the Ganges, the Brahmaputra, and Megnha, which meet in Bangladesh and flow through to the Bay of Bengal. Bangladesh has a tropical monsoon climate, with rainfall averaging 2,200mm annually. Some 80 per cent occurs between May and September, although there is considerable regional and intra-and inter-seasonal variation. Most land is highly fertile alluvial soil, well suited for agriculture.

In existence for only 41 years, Bangladesh (former East Pakistan) is a relatively new country that became independent in 1971 after civil war with East Pakistan (Baxter 1984; 1997; van Schendel, 2009). Studies around the time described a densely settled population of about 75 million, who were growing rapidly (at 3 per cent annually), with low life expectancy (<50

[19] Bangladesh is located between Latitudes 20° 34 and 26° 38N and Longitudes 88° 01 and 92° 41 E.

years), low literacy (<20 per cent), high unemployment (25-30 per cent) and poverty ($50-70 per capita), extremely vulnerable to flooding, heavily dependent on a rice-based agriculture sector (55 per cent of GDP) that could not provide food security, with only one major cash crop (jute, 90 per cent of export earnings), and limited infrastructure that had been devastated by the civil war and a major cyclone in the year before Independence (World Bank, 1972). These were only rough estimates because data was scarce, and much of what did exist had been part of integrated statistics for all of former East and West Pakistan. FAO, USAID, and the World Bank had financed studies in the 1960s for irrigation and flood control, but there was relatively little time-series hydrologic data (World Bank, 1968), a problem that continues to complicate long-term climate analysis for Bangladesh.

Starting from this very fragile base, Bangladesh has achieved considerable improvement in growth, living conditions, and food security. Economic growth averaged nearly 5 per cent in the 1990s, and nearly 6 per cent since 2000 (IMF, 2011).[20] There has also been tremendous demographic change: the 2011 Census (BBS, 2011a) reported a population of 149.7 million, making Bangladesh one of the most densely populated countries in the world.[21] The 2010 Household Income and Expenditure Survey (HIES) reports that the incidence of poverty has fallen from 56.7 per cent in 1991-92, to 31.5 per cent in 2010.[22]

In spite of this progress, Bangladesh is still a lower income country.[23] It is also considered to be among the countries that are most vulnerable to the impacts of climate change and climate variability (Wheeler, 2011). Large portions of the population—in particular, extremely poor

[20] Constant GDP growth averaged 4.9 per cent during 1992-2000, and 5.9 per cent during 2001-10. The IMF estimate of GDP growth for 2011-12 is 5.96 per cent.

[21] UN Department of Economic and Social Affairs, Population Division, http://esa.un.org/unpd/wpp, accessed 29 August, 2012.

[22] BBS uses a lower and upper poverty line. The lower line captures households whose total expenditures (consumption) are less than the amount needed to acquire a basic food basket of 2,122 calories/person/day. The upper poverty line captures households whose expenditures are less than that needed to acquire both the food basket and a set of non-food items consumed by those close to the food poverty line. The lower line is a measure of extreme poverty, the upper line of moderate poverty. BBS also computes a poverty gap and squared poverty gap to measure the depth and severity of poverty, respectively (BBS, 2011b). These data are obtained from the HIESs conducted every five years (latest in 2010). Several other measures of poverty commonly used for cross-country comparisons include the share of the population living on less than US$2 and less than US$1.25 per day, calculated by the World Bank (data.worldbank.org); and the Human Development Index (HDI, www.hdr.undp.org) and Millennium Development Goals (MDGs, www.un.org/millenniumgoals), both of which include a broader set of non-income indicators. Other, less common indices attempt to measure concepts of 'happiness'. See, for example, the Happy Planet Index issued by the New Economics Foundation (nef, www.happyplanetindex.org) and the Gross National Happiness Index developed by the Government of Bhutan (www.grossnationalhapiness.com).

[23] This is a World Bank classification, used by the international community. The latest edition (5 July, 2011) classifies economies with a GNI per capita of US$1,025 or less as 'low-income' (http://data.worldbank.org/about/country-classifications/country-and-lending-groups#Low_income, accessed 30 July, 2012).

rural communities—depend on highly climate-sensitive natural resources for livelihoods, mainly agriculture and fisheries (Agrawala et al., 2003; Tanner et al., 2007; MoEF, 2005, 2008, 2009; CCC, 2009c; World Bank, 2010). While regional-level climate change projections are not robust enough to forecast the exact nature of future impacts in Bangladesh, the majority of models predict that current trends will intensify, including increased variability of weather patterns and unpredictability of extreme weather events. This is likely to have profound implications for development and poverty reduction (ibid.).

4.3. Bangladesh: socio-economic context

4.3.1. Agriculture and the changing economy

Since independence in 1971, the economy of Bangladesh has undergone significant structural transformation. GDP has more than tripled, and it is projected that by 2020 Bangladesh may become a middle-income country (MoEF, 2008: 1; Narayan et al., 2009). There has been a progressive shift in sector composition, with agriculture having decreased to less than one-fifth of GDP (Table 4).

Table 4: Sector composition of GDP, 1980-2011 (%)

	Year				
Sector	**1980**	**1990**	**2000**	**2010**	**2011**
Agriculture	31.6	30.3	25.5	18.6	18.4
Industry	20.6	21.5	25.3	28.5	28.6
Services	47.8	48.3	49.2	53.0	53.0

(Source: World Development Indicators, 2012)

This transformation reflects a shift away from dependence on jute exports, and the expansion of export-oriented garment and knitware manufacturing, which accounted for nearly four-fifths of exports by 2008-09 (Murshid et al., 2009: iii). Strong remittances from Bangladeshis working overseas, a decrease in the population growth rate, education of women, and improvement of the Human Development Index from 0.259 in 1980 to 0.469 in 2010 (UNDP, 2010)[24] have been other important positive developments.

Although agriculture's contribution to GDP has decreased, the sector continues to play a critical

[24] In 2010, UNDP recalculated HDI values for all countries and applied them retroactively to 1980, so figures cited here may differ from those in literature published before the UNDP revision.

role in Bangladesh. Some 75 per cent of the population and 85 per cent of poor people live in rural areas (BBS, 2011b) and are directly or indirectly dependent on agriculture; the sector accounts for about half the national labour force (BBS, 2010); and it underpins the country's food security. Agriculture growth has averaged 3.7 per cent annually since 1990 (World Bank, 2012),[25] and the fact that it outpaced the rate of population growth has helped Bangladesh to reach near food self-sufficiency (Narayan et al., 2009; Akter and Jaim, 2002). The push to overcome the chronic food grain shortages in the post-Independence period (ibid, 2002) was achieved through the development and widespread adoption of High Yielding Variety (HYV) rice and expansion of the area under *boro* cultivation, particularly in the north, supported by groundwater irrigation and fertilizer use. The National Agricultural Research System (NARS) played an important part in coordinating the work of a range of national agricultural research institutes (Asaduzzaman et al., 2010), in cooperation with the Consultative Group on International Agricultural Research (CGIAR), particularly the International Rice Research Institute (IRRI).

Agriculture still faces various challenges. Among these, there are concerns about the environmental sustainability of expanding *boro* cultivation. It produces higher yields compared with the *aus* and *aman* (wet season) crops and is not as vulnerable to flooding because it is grown during the dry season (Haq, 2008). However, the expansion of groundwater irrigation also contributed to decreasing water tables over recent decades (Yu et al., 2010: 6). Climate change projections suggest that drought may increase in some areas (Section 4.6.3 below) and continued pressure on groundwater resources could exacerbate the impacts. This is an example of increasing vulnerability to impacts associated with climate change being partly the result of man-made agriculture policy choices. The challenge in future will be to manage water resource issues, as well as land degradation, changes in resource quality (e.g. salinity), and other climate change risks, in ways that allow Bangladesh to continue improving yields and food production, to meet the needs of a growing population (Yu et al., 2010; Asaduzzaman et al., 2010).[26]

The structure of rural livelihoods is also changing. The 2010 Labour Force Survey shows a decrease nationally in the share of people employed in agriculture, from 51.7 per cent in 2002-03, to 47.3 per cent in 2010. The 2010 HIES shows that income sources in rural areas are diversified, and that the share of total income coming from agriculture has decreased from 35.4 per cent in 1995-96 to 29.73 per cent in 2010.

[25] Source refers to http://data.worldbank.org, accessed 17 March 2012.

[26] Manufacturing and services are becoming increasingly important to GDP growth; however compared to agriculture, there is much less analysis of how these other sectors are vulnerable to climate change. One recent study of long-term GDP growth trends has identified relationships between performance of both agriculture and non-agriculture sectors, and climate patterns (Dell et al., 2012).

Table 5: Share of Household Income from Agriculture (%)

	1995-96	2010
National	26.3	20.4
Rural	35.4	29.7

(Source: BBS, 2011b)

The last three Agricultural Censuses (1983-84, 1996, 2008) also show that landlessness has increased:[27] for example, in the Division where field sites are located, there was an increase from 11 to 14 per cent in the share of landless households, and these are heavily concentrated in the lowest income deciles. Monthly incomes of landless households were 68 per cent of the average for the Division, and just under half the national average for all Bangladesh. Landless households spend more of their expenditures on food (70 per cent) than do all rural households (59 per cent) or all households nationally (55 per cent). In sum: (1) the share of people working in agriculture is decreasing slowly (although absolute numbers are higher because of population growth); (2) the incomes of those remaining in the sector are diversified, and the share of agriculture as a source of income has decreased; and (3) landlessness is rising, with a growing proportion of people working as wage labourers.

4.3.2. Poverty and extreme poverty

As indicated in Section 4.2, Bangladesh has achieved a major reduction in poverty levels. According to the 2010 HIES, 31.5 per cent of the population (about 46.8 million people) now live below the upper (moderate) poverty line and 26.2 million people below the lower (extreme poverty) line (Table 6).[28]

[27] The 2010 HIES appears to differ, in that it shows a slight decrease in landlessness, but this is for agriculture *and* non-agriculture households. The 2008 Agriculture Census deals with agricultural households.

[28] See footnote 22 for an explanation of upper and lower poverty lines. With regard to absolute figures, a lot of literature showed higher numbers of people thought to be below the upper poverty line (e.g. 56 million according to World Bank 2008a: 2), but these were published before the latest 2010 HIES and 2011 Census. These recent surveys showed that demographic change (decreasing fertility and population growth) had been sharper than many had realised.

Table 6: Evolution of moderate and extreme of poverty, 1991-2010 (%)

	1991-92	2000	2010
Upper poverty line			
Rural	58.8	52.3	35.2
Urban	42.8	35.2	21.3
National	**56.7**	**48.9**	**31.5**
Lower poverty line			
Rural	43.8	37.9	21.1
Urban	24.0	20.0	7.7
National	**41.1**	**34.3**	**17.6**

(Source: BBS, 2011b)

Progress has also been greater in some regions than others, with the highest poverty incidence in the Rangpur Division where the fieldwork sites are located (Table 7).

Table 7: Incidence of moderate and extreme poverty by Divisions, 2010 (%)

	Upper poverty line (moderate poverty)	Lower poverty line (extreme poverty)		
Division	**Overall**	**Overall**	**Rural**	**Urban**
Barisal	39.4	26.7	27.3	24.2
Chittagong	26.2	13.1	16.2	4.0
Dhaka	30.5	15.6	23.5	3.8
Khulna	32.1	15.4	15.2	16.4
Rajshahi	29.8	16.8	17.7	13.2
Rangpur	**46.2**	**30.1**	**30.8**	**24.0**
Sylhet	28.1	20.7	23.5	5.5
National	**31.5**	**17.6**	**21.1**	**7.7**

(Source: BBS, 2011b)

In addition to falling poverty rates and improving HDI, the Gini coefficient of inequality has decreased, life expectancy has improved, child mortality has decreased, women's economic participation has improved, and there is virtual gender equality in primary and secondary education due largely to conditional safety net programmes that require families to enrol female children (Narayan et al., 2009; UNDP, 2010; World Bank, 2011). At the same time, while the improvement since Independence seems extraordinary (in the early 1970s, about 80 per cent of the population was considered poor, compared to just under one-third now), the decrease is lower in absolute terms (60 million at Independence v. 47 million now), because of population growth in the interim.

Regarding regional differences, there is evidence that “severe and repeated community-wide shocks contribute to poverty traps in certain areas of the country" (World Bank, 2008a: xv). This means that achievements in poverty reduction have not been evenly distributed; some areas have experienced high rates of chronic poverty, in particular parts of the Northwest and the coastal belt; and areas already suffering from chronic poverty are also likely to be disproportionately affected by future shocks, including climate change-related stresses, i.e. more frequent and intense flooding, drought, cyclone, and riverbank erosion (MoEF, 2009; World Bank, 2010).

UNICEF makes a similar observation about regional disparities. Using findings from the 2009 Multiple Indicator Cluster Survey (BBS and UNICEF, 2010) to analyse progress towards achieving the Millennium Development Goals (MDGs), UNICEF finds that the proportion of poor people living in poor performing districts is 20 per cent higher than in high performing districts. The poor performing districts also suffer from greater geographic isolation related to seasonal accessibility problems (i.e. greater isolation due to climate-related factors). Ali and colleagues (2006) use HIES data to analyse the fact that some regions are lagging relative to others. The World Development Report on Reshaping Economic Geography discusses cross-country data on ‘leading and lagging’ regions (World Bank, 2008b: xxiii).

4.3.2.1. Characteristics of extreme rural poverty in Bangladesh

Despite significant focus on poverty reduction in Bangladesh over the decades since Independence, it has proved difficult to move chronic poor[29] people out of poverty and improve their human development indicators. This has led to increasing efforts by academics, governments, and development practitioners to better understand the complex and inter-related factors and structural conditions that might explain the qualitative differences between poverty and chronic poverty.

Among the various facets of deprivation, one of the defining characteristics of extremely poor rural households in Bangladesh is their high level of biophysical vulnerability (Chambers, 1989; O’Brien et al., 2004). Given population density, extremely poor people in rural areas are often

[29] Referred to by different development organizations and academics as the ‘extreme poor’, ‘chronic poor’, ‘destitute poor’, ‘ultra poor’ (Seeley et al., 2006: 1)—although some of these terms signify different things, i.e. depth (ultra poor) vs. duration (chronic poor) of poverty, with some divergent opinions regarding the number of years required for classifying a household as ‘chronically’ poor (Hulme and Shepherd, 2003). In discussing seasonality and ultra poverty, Michael Lipton (1986) defined the ultra poor as “a group of people who eat below 80 per cent of their energy requirements despite spending over 80 per cent of their income on food.” See also footnote 24 for BBS’ use of the terms.

forced to live on poor quality land in marginal areas (e.g. riverine island *chars),* which makes them generally more at risk from erosion, storms, and flooding. The 2010 HIES found the incidence of extreme poverty among rural households that own no land, or less than 0.5 acre of land (essentially enough for a house), to be above one-third; the incidence fell to 4 per cent for those with 2.5 acres or more. Around 75 per cent of households in the poorest decile of the population lack land (Zaman, 2006). Those households that tend not to own land are unable to grow their own food, which makes them highly vulnerable to the kind of food price spikes that have hit Bangladesh hard in recent years. Many extremely poor rural households also lack secure employment and need to rely on casual agricultural day labour, which makes them highly vulnerable to seasonal unemployment and weather-related shocks and stresses.

Idiosyncratic shocks (Dercon, 2010) hit extremely poor households hard, in particular illness and injury, given their often sub-optimal state of health and nutrition, and involvement in relatively dangerous and risky employment. Health shocks can both entrench poverty or push households and individuals into extreme poverty, especially when the main income earner is affected. Another dimension of high exposure to various kinds of risk is the inability to access resources (e.g. physical or financial assets, socio-political support) to cope when shocks occur (Sen, 2003; Krishna, 2010).

Extremely poor households also suffer from very low levels of human capital (education and skills), making it hard to access non-agricultural employment, except for casual labour. According to the HIES 2005, only 20 per cent of the poorest households were headed by individuals with education, and less than one per cent of these had completed secondary school (Zaman, 2006: 28). The fact that family members cannot secure better paying jobs outside of rural areas, especially internationally, results in only two per cent of extremely poor households in the bottom decile receiving remittances from abroad, as compared to 10 per cent on average. Extremely poor households tend to be larger than the average household in Bangladesh, with greater dependency ratios; the average household size of the bottom 10 per cent of houses in Bangladesh was 5.4, when the national average stood at 4.8 (ibid.: 28). Finally, social and geographic exclusion often mean that extremely poor people lack access to government safety nets and NGO/donor development programmes. This does not mean that they are passive victims; they demonstrate considerable agency and ingenuity in the struggle to secure their livelihoods in the face of the various dimensions of deprivation they face on a daily basis (Wisner et al., 2003).

While the above paragraphs review some of the most common features of being extremely poor in rural Bangladesh, there are two caveats. First, this group is heterogeneous; the experience of

extreme poverty varies greatly among individuals, households, and across regions. Second, the various actors working with extremely poor communities often emphasize different drivers of poverty as being the most important (e.g. lack of assets, social vulnerability, exclusion, lack of political voice, structural factors, etc.) depending on their own disciplinary background, experiences, and the policy approach of the institution they work with (Hunzai and Ahmad, 2008).

4.3.2.2. Policy approaches to poverty reduction

Policy approaches to poverty and chronic poverty reduction in Bangladesh have evolved in several important ways over time. In the pre-Independence period, the Comilla Cooperative Development Project piloted an integrated approach to rural development that included strong features of participation by beneficiaries, which served as a model for many future community-driven development initiatives in Bangladesh and other countries (although the cooperative itself did not survive after Independence). In the late 1970s, the Grameen Bank began piloting ways to extend credit to the rural poor, through solidarity groups that engaged in both lending and borrowing. Another non-governmental initiative, the Bangladesh Rural Advancement Committee (BRAC) also began working in the 1970s, and has become one of the largest micro-finance institutions in the world. Both Grameen and BRAC focused heavily on women, and both also engaged in other complementary activities (e.g. Grameen in village telecommunications, BRAC in healthcare). Recognizing that although it was reaching the poor, it was not getting to the ultra poor, BRAC began the CFPR (Challenging the Frontiers of Poverty Reduction) in 2002, testing the use of grants initially to provide a basic level of security that would enable the ultra poor to risk engaging in new income-generating activities, followed by graduation into microfinance.

For its part, the Government has invested heavily in infrastructure development, with a major focus on water resources, especially irrigation and flood control, and social safety nets. In agriculture, policies have emphasized intensification and productivity, through irrigation and extension of high yielding varieties (HYV) of paddy, as discussed above. It has prioritized female education, using the conditional cash transfer strategy as a tool to overcome obstacles for girls to attend school. Finally, Bangladesh has been active for years in international fora on climate change and impacts on the poor, although domestic policies have been more focused on short-term coping through safety net programmes, and infrastructure and engineering solutions (e.g. protective flood works), than on the social dimensions of long-term adaptation by the rural poor.

4.4. Rajshahi-Rangpur Division, Gaibandha District, and fieldwork locales

Until recently, Rajshahi Division in Northwest Bangladesh was the largest of the country's six divisions in geographic terms and the second largest (after Dhaka) in population. In January 2010, while fieldwork was on-going, Rajshahi was sub-divided into two Divisions: eight districts, including Gaibandha where the fieldwork *upazilas* are located, became part of a new seventh Rangpur Division, and another eight districts stayed as part of a reconfigured Rajshahi Division. Many secondary sources used in this chapter refer to Rajshahi, as they pre-date establishment of the new Rangpur Division; these are referred to as Rajshahi-Rangpur below. In some cases where recent surveys make it possible, data for Rangpur alone are noted. According to the 2011 Census, 11 per cent of the total population of Bangladesh, or 16.4 million people, live in the new Rangpur Division (Table 8).

Table 8: Population of Rajshahi and Rangpur, and average growth rate 2001-2011

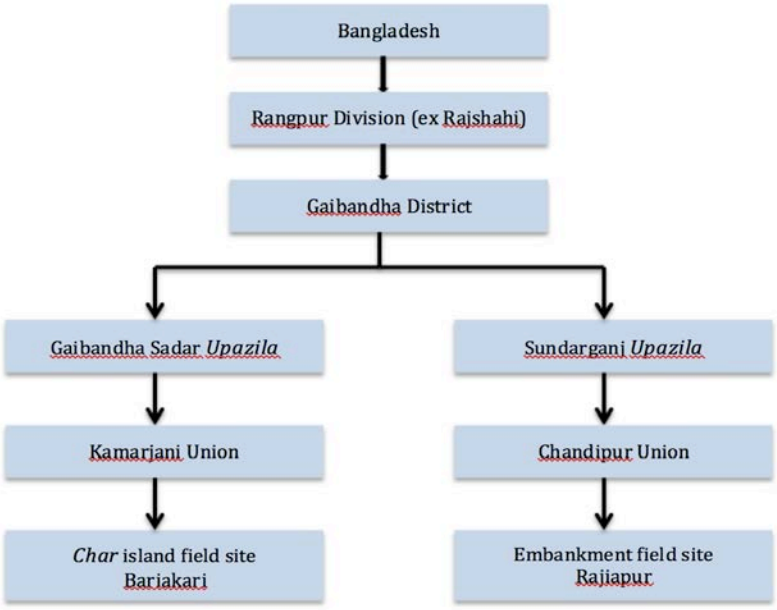
Administrative unit	2011 ('000)	2011 (%)	Annual change 2001-'11 (%)
Rajshahi-Rangpur (ex-Rajshahi)	35.6	(23.8)	1.15
New Rajshahi	19.2	(12.8)	1.1
New Rangpur	16.4	(11.0)	1.2
Bangladesh	**149.8**	**(100)**	**1.34**

(Source: BBS, 2011a)

4.5. Socio-economic context

This section reviews the socio-economic context of Gaibandha District (*Zila*) in Rangpur Division. Gaibandha is one of the poorest and most disaster-prone districts in Bangladesh. Its placement at the confluence of the Brahmaputra-Jamuna and Teesta rivers makes it particularly vulnerable to alternating floods and drought, and riverbank erosion, all of which severely constrain livelihoods. The geographic focus of this section is on the *upazilas* and unions in which the two field sites are located (Figure 3). More specifically, the focus is on extremely poor people in rural areas; and how their conditions fare in relation to the rest of Gaibandha District, Rangpur Division, and Bangladesh generally; and the climate—livelihoods interactions that underlie their vulnerability.

Figure 3: Location of field sites by administrative unit



Extremely poor people throughout rural Gaibandha exhibit many of the characteristics discussed in Section 4.4 on Rajshahi-Rangpur: most depend heavily on agriculture; food insecurity is common; most do not own their own land, and therefore work as sharecroppers, tenants or day labourers for others; and they lack the necessary skills to access non-agricultural work. They usually live in the most exposed and marginal areas of Gaibandha, including riverbanks and *char* islands, where biophysical exposure to climate-related shocks and stresses is greatest, and many of them lack the resources necessary to ensure that they can cope successfully. Non-income indicators of well-being are poor, and they have relatively low access to government services and NGO development programmes.

4.5.1. Demographics, poverty, and agriculture

Gaibandha is one of the eight districts that make up the newly formed Rangpur Division. It comprises seven *upazilas*, of which Sundarganj and Gaibandha Sadar are the second and third largest, respectively, in terms of land area and population. Table 9 summarizes key area and demographic features.

Table 9: Area and population by administrative unit, 2011

Administrative Unit	Area (km²)	Population ('000)	Density (pop./km²)	% male	% female	Sex ratio	% rural	Avg. HH size**
Bangaldesh	**147,570**	**149,772**	1,015	50.1	49.9	100	76.7	4.4
Rangpur Division	**16,185**	**16,412**	1,014	49.9	50.1	100	86.6	4.1
Gaibanda District	**2,115**	**2,472**	1,169	49.1	50.9	97	91.2	3.9
G. Sadar Upazila*	**324**	**454.9**	1,404	48.9	51.1	96	78.5*	4.0
Kamarjani Union	**32.5**	**13.2**	407	49.7	50.3	99		3.8
Sundarganj Upazila	**370**	**479.7**	1,296	48.9	51.1	96	96.5	3.8
Chandipur Union	**21.6**	**32.1**	1,486	50.0	50.0	100		3.7

* This *Upazila* includes the main city of Gaibandha, which explains the overall lower share of rural population. If one excludes the 'urban' area from the total (i.e. counting only 'other urban' and 'rural'), the share of rural in the total was 94.89 per cent in 2001 and 96.14 per cent in 2011.

** Using enumerated (versus adjusted) population and HH figures (BBS, 2011a).

Poverty rates are high in Gaibandha, relative both to other districts in Rangpur and nationally. According to the 2009 poverty mapping exercise, between 48 and 60 per cent of the population of Gaibandha lived below the upper poverty line in 2005 (World Bank et al., 2009); this compares with 46 per cent for Rangpur and 31.5 per cent nationally (Table 7). Sundarganj and Gaibandha Sadar both report somewhere between 44 and 55 per cent of the population in poverty (ibid.: 8). Rates of extreme poverty are also very high. According to BBS and WFP (2004: 35), between 37 and 55 per cent of the population of every *upazila* in Gaibandha was living in extreme poverty, based on a composite measure including household per capita calorie intake and the cost of basic needs (ibid.: 2). Levels of hard-core food poverty[30] were 'high' in Gaibandha Sadar (20-30 per cent) and 'very high' in Sundarganj (>30 per cent) (ibid.: 39).

Land ownership and occupation are particularly important correlates of poverty in Gaibandha (Ahmed, 2004). Wages for agricultural day labour in Gaibandha are among the lowest in the country.[31] Comparing poverty maps with maps illustrating access to major markets (e.g. Dhaka), World Bank et al. (2009: 11) finds a significant correlation, highlighting the great distances and lack of adequate transport links to Dhaka from, in particular, coastal areas and *monga*-prone areas in the Northwest. Gaibandha-based survey data indicate that migration is rather common, with 25.8 per cent of the labour force migrating to other areas for work in 2003 (SIPP, 2004: 26). This may be due to a combination of landlessness, low wages and limited opportunities for non-farm work, lack of access to major markets due to poor infrastructure and

[30] Measured by the proportion of the population with a caloric intake of lower than 1,808 kcal per day (BBS and WFP, 2004: 39).

[31] The average rate reported by respondents in fieldwork sites is between 80 *taka* and 100 *taka* per day for males and between 30 *taka* and 70 *taka* for females.

weather conditions during part of the year, and high vulnerability of agricultural production to various natural hazards (alternating floods and drought, and riverbank erosion).

4.5.2. Human development

In 2010, BBS and UNICEF ranked *upazilas* on progress towards achieving the MDGs. Sundarganj is classified in the 'worst performing' category, whereas Gaibandha Sadar is ranked an 'average performing' *upazila* (BBS and UNICEF, 2010: 11). As a District, Gaibandha ranks in the 'worst performing' category (ibid.: 23).

Educational attainment and literacy indicators are closely correlated with poverty; as a District, Gaibandha scores below Rangpur and Bangladesh generally (Table 10).

Table 10: Literacy and school attendance rates by administrative unit, 2011 (%)

	Administrative unit						
	Bangladesh	**Rangpur Division**	**Gaibandha District**	**G. Sadar Upazila**	**Kamarjani Union**	**Sundarganj Upazila**	**Chandipur Union**
Literacy rate (7 yrs +)	**51.8**	**47.2**	**42.8**	**47.5**	**28.2**	**40.6**	**37.3**
Male	54.6	50.6	46.3	50.8	30.1	44.3	41.1
Female	49.4	43.8	39.5	44.4	26.3	37.1	33.6
School attend. (5-24 yrs)	**52.7**	**55.0**	**52.7**	**52.5**	**47.9**	**52.2**	**49.9**
Male	54.6	57.6	56.5	55.8	52.1	55.7	52.7
Female	50.8	52.5	49.0	49.4	43.9	48.7	47.2

(Source: BBS, 2011a)

NGO literature suggests that *char* areas in Gaibandha are likely to have worse literacy rates, due to poorer access to education, and basic services generally (Kabir, 2006). The literacy rate in Kamarjani stands out as extremely low (28.2 per cent), despite being in an *Upazila* with a better-than-average rate (Gaibandha Sadar, 47.5 per cent). Bangladesh has achieved gender parity in primary education, but there are still imbalances at the post-primary level. These are also apparent in Gaibandha, with Kamarjani again standing out for its lower-than-average female school attendance rate.

On child health, at district level, Gaibandha scores in the 'medium risk' category based on a composite Child Risk Measure (CRM) (BBS and UNICEF, 2010). Ibid. reports that Gaibandha's composite score has remained the same in 2000, 2003, and 2009 (Rooy and Wang, 2009).

Table 11: Health: Child risk measure (CRM) indicators by administrative unit

CRM indicator	Gaibandha Sadar Upazila	Sundarganj Upazila
Mortality of children under 5 yrs.*	Worst performance	Average performance
Births attended by skilled health professional*	Average performance	Worst performance
Stunting in children under 5 yrs. (height for age)**	40-50 %	50-60 %
Child nutrition at 5 yrs (weight for age)**	Worst performance	Worst performance

* BBS and UNICEF, 2010: 17 and 19
** BBS and WFP, 2004: 40 and 42

4.5.3. Access to basic amenities and services

Access to basic amenities are important quality of life factors in themselves, and also underpin other human development goals (e.g. health, education, awareness, skill levels, and empowerment). Table 12 summarizes key findings of the 2010 Census for Gaibandha, and the two Districts and Unions where field sites are located.

Table 12: Access to basic services by administrative unit, 2011 (%)

	Gaibandha District	G. Sadar Upazila*	Kamarjani Union	Sundarganj Upazila	Chandipur Union
Sanitation					
Sanitary latrine	30.5	25.1	37.7	27.5	21.0
Non-sanitary latrine	43.7	47.9	30.9	45.6	51.5
None	25.9	27.0	31.3	26.9	27.9
Drinking water					
Tap	1.0	1.6	0	0.1	0.1
Tubewell	94.9	96.0	97.0	94.0	91.4
Other	4.1	2.4	3.0	6.0	8.6
Electricity	29.4	*52.6	16.4	22.1	15.9

* Higher average electricity rates reflect the fact that the main city of Gaibandha is in this *upazila*. The rest of the *upazila* has much lower connection rates (e.g., Kamarjari Union)
(Source: 2010 Census, community table series 14 and 15).

4.6. Bangladesh: Climate context

Bangladesh has been identified as one of the most vulnerable countries to climate change and the associated impacts, due to a combination of geographic and socio-economic characteristics. These include: location in one of the earth's largest deltas; a significant share of the territory being at or near sea level; high population density and pervasive poverty, with persistently high rates of chronic poverty; and heavy reliance on climate-sensitive livelihoods—particularly in agriculture and fisheries, and especially among poor people (Agrawala et al., 2003; Tanner et al., 2007; World Bank, 2000; MoEF, 2005, 2008; CCC, 2009a, 2009b).

Evidence is accumulating of an increase in the frequency and variability of the kinds of climate events the country has experienced historically (SAARC, 2009; Habib, 2011; CCC, 2009b). These changing patterns are projected to increase in the future as climate change accelerates, with adverse consequences for the livelihoods of millions of people, particularly poor and extremely poor communities who tend to have limited adaptive capacity (Smit et al., 2001; Khan et al., 2010; Adger et al., 2007). This section reviews the history of natural hazards in Bangladesh; the meteorological evidence of gradual increases in temperature, increasingly erratic and unpredictable precipitation patterns; and the main impacts associated with these changes (e.g. flooding, erosion). It then discusses the forecasts of future climate change and expected secondary impacts, outlining ways that these may exacerbate the nexus of livelihoods—climate issues that rural communities on the ground already confront, including those in the fieldwork area. It concludes with a brief discussion of Bangladesh's evolving policy approach to climate change.

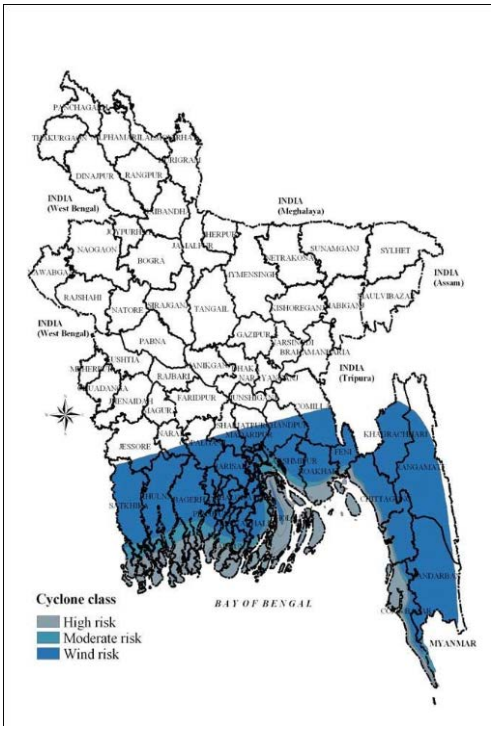
4.6.1. Climate-related hazards in Bangladesh

This section discusses the following hazards affecting Bangladesh: cyclones, floods, riverbank erosion, and droughts (CCC, 2009a). All of these events have strong climate-related dimensions (e.g. temperature trends) as well as socio-economic drivers (e.g. river control engineering, land use patterns, irrigation for agriculture). In addition to loss of life and economic shocks, hazards affect the livelihoods of millions of people, often through damage to key sectors in affected regions, including especially agriculture, infrastructure, education, and health. There is evidence that these hazards have significantly affected the gains from GDP growth and poverty reduction. For instance, "between 1991 and 2000, 93 major disasters were recorded, resulting in nearly 200,000 deaths and causing US$5.9 billion in damage with high losses in agriculture" (Selvaraju et al., 2006: iii).

4.6.1.1. Cyclones

Bangladesh is particularly vulnerable to tropical cyclones (UNDP, 2004, cited in MoEF, 2009: 5). Of the 508 cyclones that have affected the Bay of Bengal region over the last 100 years, 17 per cent have hit the coastal belt in Bangladesh, with the most recent major cyclones occurring in 1970, 1985, 1991, 2007, and 2009 (GoB, 2008). The national cyclone preparedness programme, which includes community-based early warning systems, awareness raising, and construction of cyclone shelters, has achieved a progressive lowering of death tolls from cyclones through the years (500,000 deaths in 1970; 140,000 in 1991; and 3,406 in 2007) (ibid. 2009). Nonetheless, Bangladesh remains one of the "worst sufferers of cyclonic casualties in the world" (World Bank et al., 2011: 377), with crippling effects on economic activity and livelihoods in the coastal region. Cyclone Sidr in 2007, for example, is estimated to have cost Bangladesh about 2.8 percentage points of GDP, with a total of about US$1.7 billion in losses and damages. The infrastructure sector recorded the highest losses, followed by agriculture, and social sectors (GoB, 2008; World Bank, 2010).

Map 3: Cyclone hazard map



(Source: Gunter et al., 2008: 18)

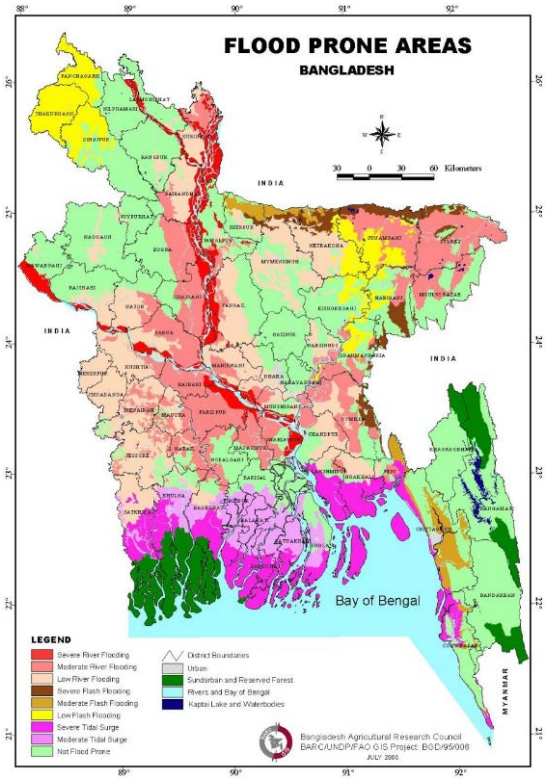
Communities in the coastal belt bore the brunt of the storm. An estimated two million people lost employment across the most affected districts (GoB, 2008), and there was widespread damage to infrastructure that is essential to local livelihoods and recovery, including roads,

schools, embankments, and homes, leaving many families homeless. Critically important resources like agricultural land and livestock were also destroyed or damaged. Shortages of clean drinking water and food supplies compound the health effects of cyclones and storm surges, not least of which are (oftentimes debilitating) injuries. This can jeopardise future income-earning potential, especially for extremely poor people, for whom physical ability to work is often the most important livelihood asset (Biswas, 2005: 131-2). Finally, salinisation of water resources is also an issue in the coastal zone, often reducing freshwater availability, negatively affecting crop production, and disrupting the livelihoods and health of communities in the area (CCC, 2009a: xv). It has been estimated that salinity-affected soil has increased by 21 per cent in Bangladesh over the last three decades (Salauddin and Ashikuzzaman, 2012: 55).

4.6.1.2. Flooding

Flooding is an annual phenomenon in Bangladesh, resulting from the country's low-lying deltaic topography and compounded by "heavy monsoon rainfall concomitant with poor drainage" (Yu et al., 2010: 10). The severity and duration of flooding varies across regions, determined by the source: river floods (affecting mainly populations living in floodplains of the Meghna, Brahmaputra, and Ganges); flooding following heavy rainfall; flash floods (most severe in areas beside the hills in India during pre-monsoon months); tidal floods (mainly in southwest and south-central regions); and storm-surge flooding (generally associated with cyclones in the Bay of Bengal) (CCC, 2009a: xiv). Around 20 per cent of the total land area is inundated annually by normal flooding from overflowing rivers during monsoon months; however these floods are usually beneficial, carrying nutrient-rich sediments that replenish soil and recharge groundwater aquifers, increasing the agricultural potential of the land (Yu et al., 2010: 10). Moderate and severe flooding, on the other hand, can cause a great deal of destruction, loss of life, health-related risks, damage to infrastructure, housing, agricultural production and livestock, and the livelihoods that depend on these, particularly in low-lying floodplains—which are mainly inhabited by poor, rural communities.

Map 4: Flood-prone areas



(Source: CCC, 2009a: 84)

In recent decades, major floods have occurred in 1988, 1998, 2004, and 2007. Effects on agriculture have been severe. For example: between 1973 and 1987, 23.8 *lakh* tons of paddy were lost due to floods (Ahmed and Hasan, 2009: 38); the 1988 flood caused an estimated 45 per cent reduction in agricultural production (ibid.: 38); and the 1998 "flood of the century" resulted in a loss of 2.04 million metric tons of rice, equivalent to about 10 per cent of targeted production in that year (Ninno et al., 2001). This created major food security issues, because rice is Bangladesh's main staple. The effect of flooding on rice production has become less crippling since about 1991, due to a shift in cropping patterns and the expansion of *boro* cultivation, the crop that is harvested before the monsoon and is substantially less vulnerable to flooding (Yu et al., 2010; Ninno et al., 2001). However, agriculture as a whole remains highly vulnerable to flooding. For instance, 70-75 per cent of total damages and losses from the 2007 floods were in agriculture: about 1.12 million hectares of cropland was either partially or fully damaged, livestock deaths equalled about 5.8 million *taka*, and losses and damages to the fisheries and forestry sectors were estimated at 1.965 million *taka* and 37.8 million *taka* respectively (DMB and CDMP, 2007).

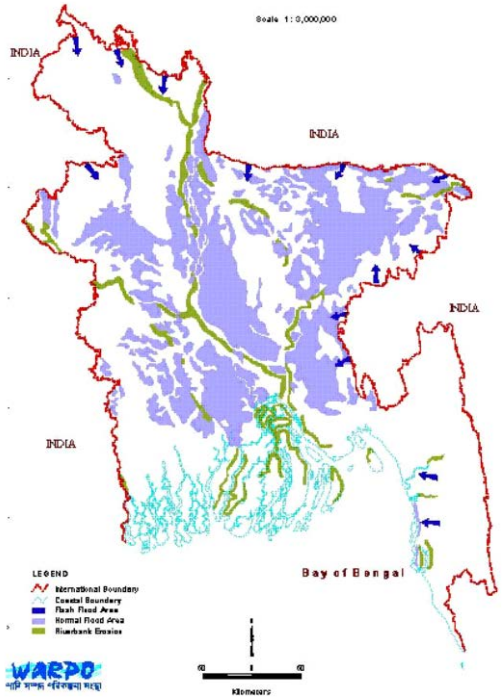
Livelihood impacts from severe floods can be crippling, especially for rural poor and extremely poor households. The damages to crops and other agriculture causes a sharp decline in employment and wages, especially for agricultural day labourers; food shortages; loss of purchasing power for basic necessities (Ninno et al., 2001: 1); and damage to critical household assets, reducing household wealth and future productive potential. In terms of area affected and damage to infrastructure, the 1988 and 1998 floods stand out as particularly severe, with 45 million and 30 million people left homeless from destruction of housing (MoEF, 2009: 17). Some 47 per cent of households surveyed by Ninno and colleagues (2001) following the 1998 floods had experienced total loss or damage to housing. Health impacts in flood-prone areas are also numerous. In addition to lowered food consumption and resultant malnutrition from loss of crops and income, communities are also exposed to diseases like cholera, dysentery, and diarrhoea, most often through contamination of drinking water due to inundation of latrines and tube wells, and exacerbated by waterlogging (Biswas, 2005: 128). Educational activities are also disrupted during flooding, especially during severe flood events. Ali and colleagues (2006: 1) sum up a range of livelihoods effects from flooding in their study of the persistence of poverty amongst rural households in disaster-prone areas of Bangladesh, concluding that "flood prone zones are the worst off among different disaster-prone areas in terms of food shortages, the incidence of extreme poverty, insufficient income, illiteracy, and a high concentration of wage labourers". The relatively greater risks to poorer people during floods are due partly to the fact that they tend to live closer to the river's edge, as confirmed by Brouwer and colleagues (2007) in their empirical study of socio-economic vulnerability to flooding in Bangladesh.

4.6.1.3. Riverbank erosion

Riverbank erosion is another serious natural hazard for communities in some regions of Bangladesh, particularly those living in the floodplains and banks of the Meghna, Jamuna, and Teesta rivers, on *char* islands, and along inland coastal rivers in Barisal Division (CCC, 2009a: xiv; MoEF, 2009; World Bank, 2010). It is caused by the pressure of rising and receding floodwaters that wear away riverbank soil (Adnan, 1991, cited in Hossain, 1993: 27). Erosion therefore occurs most between the months of August and September, and is exacerbated during periods of heavy flooding and rainfall (CCC, 2009a), as well as by deforestation and the degradation of vegetation in riverbank areas (Biswas, 2005: 133). An estimated 9,000 hectares of mainland and 5,000 hectares of *char* land are reworked each year by erosion (FPCO, 1995: 7, cited in Hutton and Haque, 2004: 6), affecting about one million people across the 35 out of 462 total administrative units of Bangladesh which are considered seriously erosion-prone (CCC, 2009a: xv). Erosion has caused loss of thousands of hectares of agricultural and homestead land and displaced entire villages, and is thus a major source of impoverishment and landlessness.

Between 1973 and 1980, 299,518 acres of land eroded within the floodplain area of Padma-Jamuna (Haque, 1983, cited in Hossain, 1993: 26); and between 1981 and 1993 over 728,000 people were displaced due to erosion along the Jamuna, Ganges-Padma, and Meghna rivers (FPCO, 1995: 7 cited in Hutton and Haque, 2004: 6). More recent studies find that "on an average, 256.1 ha and 622.2 ha of total land area of Gaibandha and Sirajganj respectively were eroded per year during the period of 1973-2009" (Uddin and Basak, 2012).

Map 5: Erosion-prone areas



(Source: CCC, 2009a: 88)

Erosion often leads to involuntary migration and the damage or complete loss of all or most of an affected household's resources (Ali et al., 2006). Recurrent displacements are common in erosion-prone areas:

"According to a study conducted in Kazipur sub-district in the mid-1980s, two-thirds of the inhabitants of the Jamuna-Brahmaputra floodplain had been displaced at least once in their lifetimes, about 17 per cent had been displaced three times and 15 per cent displaced 10 times (Haque, 1988)… such multiple displacements hinder any prospect of recovery and long-term rehabilitation" (Hutton and Haque, 2004: 6).

The scale of erosion-induced displacement over recent decades in Bangladesh has implications for the rate of urbanization and expansion of urban squatter settlements, since this is where many erosion victims end up (Ali et al., 2006). Urbanization has increased dramatically since Independence in 1971, resulting largely from internal migration from rural to urban areas, rather than urban population growth (Hutton and Haque, 2004). Akhter (1984, cited in Uddin and

Basak, 2012: 32) observed that about “one-quarter of slum dwellers migrated from rural areas to Dhaka because they were uprooted by natural disasters”. In terms of the effects on family and community cohesion, Hutton and Haque (2004) find that despite frequent relocations, erosion does not necessarily precipitate the breakdown of local networks, since whole communities and neighbourhoods are often affected simultaneously. Furthermore, “the maintenance of rural reciprocity networks is key to displacees’ survival in that these relationships provide a minimum level of mutual economic and social support” (Rogge and Elahi, 1989, cited in Hutton and Haque, 2004: 49).

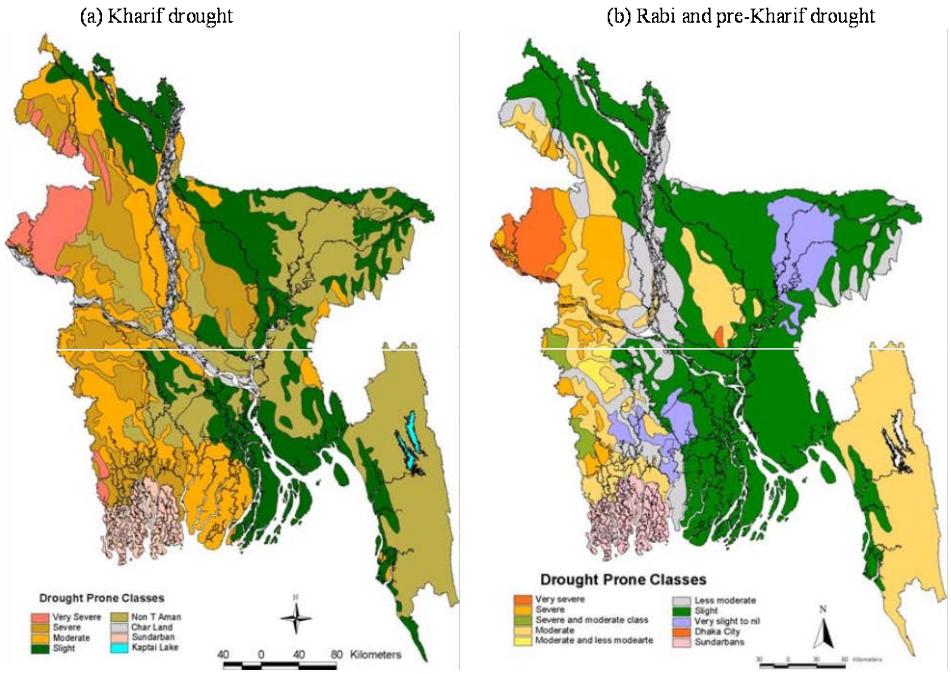
The impoverishing effects of loss of homestead and agricultural land can be severe, and take years to recover from. The most common effect on children—school drop-outs due to evacuation and/or erosion of schools and family displacement, can have life-long impacts in terms of reduced educational attainment (Uddin and Basak, 2012). Despite the severe impacts of recurrent erosion on livelihoods of some of the poorest communities (e.g. *char* dwellers), the hazard remains largely undocumented, receiving far less attention than cyclones and flooding (Hossain, 1993; Biswas, 2005: 133). Furthermore, while communities living on *char* islands and other erosion-prone areas have developed coping strategies to deal with the effects of various weather-related events, very few formal or informal mechanisms exist for addressing the consequences of erosion (except maintenance of local networks and social support that comes with them), leading Ali et al. (2006: 9) to highlight “the importance for according priority to meeting the needs of the extremely distressed population residing in river-erosion belts (including remote *char* lands)”.

4.6.1.4. Drought

Unlike the rapid onset nature of cyclones, some kinds of flooding, and riverbank erosion, longer-term increases in drought conditions come on more slowly, as a “creeping phenomenon" (CCC, 2009a: xiv). Drought usually occurs during the dry season, from November to May, and is particularly severe in parts of Northwest Bangladesh, which has lower rainfall than the rest of the country, with the Barind tract area in the west being most sensitive (Baas and Selvaraju, 2008; MoEF, 2009). In addition to seasonal droughts, intermittent drought conditions occur throughout the year, resulting from periods of up to two weeks without rainfall. This is common, for instance, in October, during “critical reproductive stages of transplanted *aman* crops”, and can result in substantially reduced yields” (Karim et al., 1990, cited in CCC, 2009a: 32). Wheat and *boro* cultivation during pre-*Kharif* season—the last weeks in March to May, which normally has high temperature, rainfall, and humidity—is also vulnerable, if such dry spells occur (Yu et al., 2010). Particularly severe droughts occurred in 1973 (in part responsible

for the 1974 famine); 1978-79 (reducing rice production by about two million tons and affecting 42 per cent of cultivatable land); 1982 (causing double the amount of rice production losses and flooding that same year); and 1997 (with a loss of one million tons of rice, valued at around US$500 million) (Selvaraju et al., 2006). Overall, it has been estimated that between 1973 and 1987, Bangladesh lost about 21.8 lakh tons of paddy due to the impacts of drought (Ahmed and Hasan, 2009: 38).

Map 6: Drought-prone areas



(Source: CCC, 2009a: 87)

Biswas (2005: 130) categorizes the livelihood impacts from drought into short and long-term, the former relating to the amount of crops lost in a particular year, and the latter referring to the potential onset of famine conditions, as well as decrease in soil moisture and therefore less optimal conditions for agriculture and a fall in the groundwater level. In addition to the effects on agricultural livelihoods through reduced crop production, access to safe drinking water can also be reduced during severe droughts, which, in turn, can lead to waterborne disease like diarrhoea (ibid.).

4.6.2. Break with historical patterns

An important starting point for understanding the possible nature of future climate change-related impacts is to explore how historical trends have evolved—i.e. temperature, rainfall, and incidence and severity of extreme events. Major findings of studies based on such historical

analysis (Solomon et al., 2007; Cruz et al., 2007; CCC, 2009b; Islam and Neelim, 2010; Yu et al., 2010; Shahid, 2010; Yusuf et al., 2008; Habib, 2011; Islam, undated; Islam et al., 2008, 2009, 2009a, 2009b; Rajib et al., 2008; Uddin and Basak, 2012; Thakur et al., 2012) include the following:

- Mean **temperatures** have increased, particularly over recent decades;
- **Precipitation** findings are more divergent. Some studies report an increase in average rainfall in recent decades (Cruz et al., 2007; Shahid, 2010; Yusuf et al., 2008; Habib, 2011), while others find that there has been a trend towards increasing variation in the pattern of rainfall throughout the year, i.e. increases in the incidence of shorter periods of more intense rainfall, and, conversely, longer periods of time without rainfall, the average annual volume of rainfall has not changed (Islam and Neelim, 2010; Yu et al., 2010; Rahman et al., 1997, cited in Shahid, 2010).
- Regarding **extreme weather and hazard events**, the meteorological record suggests that cyclones, heavy rainfall, flooding, riverbank erosion, and drought have been occurring more frequently, less predictably, and often with greater intensity than similar events one or two decades ago (Islam and Neelim, 2010: 11; Thakur et al., 2012; Uddin and Basak, 2012; Asada and Matsumoto, 2009; Salauddin and Ashikuzzaman 2010; Habib, 2011; Islam et al., 2009a, 2009b; Rajib et al., 2008; Yusuf et al., 2008; Shahid, 2010).

Annual and seasonal mean **temperatures** have increased during 1961-2007 in Bangladesh. More specifically, the Climate Change Cell (CCC) found an overall mean annual temperature increase of +0.10°C per decade between 1948 and 2007 and +0.21°C increase per decade from 1980-2007, meaning that the most rapid temperature increase has occurred in the more recent period (CCC, 2009b). In terms of seasonal differences, average minimum temperatures have increased during both winter (December-February) and summer (March-May), although the increase in winter temperatures has been slightly greater than during summer. Various studies conclude that the greatest increase in daily minimum temperature has occurred in February (+3.4°C over the last 100 years), and the greatest increase in daily maximum temperature in November (+2.7°C over the last 100 years) (Islam, undated: 12; Shahid, 2010; Yusuf et al., 2008). There is also some regional variation with coastal weather stations generally reporting greater temperature rises in both average minimum and maximum summer temperatures, than those recorded by northern weather stations. The same is true of average maximum temperatures in winter, with far greater increases in the coastal belt; some weather stations in the Northwest actually show a decline in average maximum winter temperatures ranging between -0.1° to -0.3°C (Islam and Neelim, 2010: 66).

For **precipitation**, based on data from 32 rainfall stations across Bangladesh during 1960-2001, Yu and colleagues (2010: 11) conclude that although average annual rainfall did not change, precipitation patterns throughout the year became increasingly erratic. Similarly, Islam and Neelim (2010: 67) identify the following historical trends: concentration of annual rainfall during monsoon months (75-80 per cent), and within monsoon season, towards the end (July and August) rather than equally distributed across the monsoon months. However, this analysis also found that rainfall patterns exhibited high variability over the long term, making it difficult to predict the nature of potential future impacts. Overall, the study concluded that "the results indicate anomalies and variabilities in the climatic variables for almost all the stations of the country and show some signal of change in the historical pattern" (ibid, 2010: 68). The general consensus around precipitation in these studies is that patterns have become increasingly variable throughout the year (MoEF, 2009). Yusuf and colleagues (2008), on the other hand, found that annual total rainfall increased by 120mm over the period 1961—2007, which is consistent with findings from Shahid (2010), that annual rainfall in Bangladesh increased at a rate of +5.53mm per year between 1958 and 2007. Brouwer and colleagues (2007) also reported an increase. The IPCC Fourth Assessment Report reports that annual mean rainfall has exhibited "increasing trends" over the last few decades (Cruz et al., 2007: 472). In terms of regional variation, Islam and Neelim (2010) report that coastal and hill-based weather stations exhibit higher historical amounts of rainfall than do those located in floodplain areas and in the north; Habib (2011) similarly finds that there has been an increasing rate of wet days in the southeast and northeast of the country.

In terms of **drought**, Islam and colleagues (2009b), citing the National Drought Mitigation Center (2006), find an increasing trend overall in recent years. Rajib and colleagues (2008) report that compared to the period 1960-75, mild and moderate drought has actually decreased, but the incidence of extreme drought has increased over the same period, particularly in Northwest Bangladesh, including Rajshahi Division (where fieldwork took place; see Section 4.6.4.1 below for more information on increasing drought and extreme weather in the fieldwork area).

Some studies also report changes in the incidence and pattern of some **extreme weather events**. A project on rainfall climatology and detection of extreme events in the SAARC region notes that analysis of tropical cyclone intensity indicates an increasing trend in the frequency and intensity of cyclones "since 1876 onward [and] particularly in the last 20 years" (Habib, 2011: 4). This finding is echoed by CRED (cited in Yusuf et al., 2008: 21) and the IPCC (Cruz et al., 2007). The SAARC (Islam et al., 2009a: 4) study finds that increases in the incidence of

extremely heavy rainfall have led to an increase in flash floods, particularly during the pre-monsoon period, and this has exacerbated certain effects of monsoon flooding, including: drainage congestion (particularly in urban areas); prolonged water logging and landslides (especially in hilly areas); and the incidence and rate of riverbank erosion.

4.6.3. Projections of future climate change in Bangladesh

While general climate models (GCMs) are not all consistent or sufficiently detailed regarding specific future climate changes in Bangladesh, for the most part they have projected warming throughout the country, with increased precipitation during monsoon seasons, and decreased rainfall in the dry season (Tanner et al., 2007; Agrawala et al., 2003; MoEF, 2009). Recent advances in applying regional climate modelling systems in Bangladesh, such as PRECIS (Providing Regional Climates for Impacts Studies), developed by the Hadley Centre in the UK and applied by the Climate Change Cell using ECHAM4 SRES A2 emission scenarios,[32] have yielded somewhat more specific insights into the possible nature of future changes in temperature and precipitation (CCC, 2009c). The results of this regional modelling work suggest that Bangladesh may experience:

- **Changes in monthly average temperatures,** ranging from -1.2° to +4.7°C in 2030; -1.2° to + 2.5°C in 2050; and -1.2° to +3°C in 2070. The extent of temperature changes would likely[33] be varied across regions and seasons, with maximum temperatures increasing during the monsoon and decreasing during other periods (CCC, 2009c: 50).
- **General increase in precipitation**, by 4 per cent, 2.3 per cent, and 6.7 per cent in 2030, 2050, and 2070, respectively, compared to observed rainfall in the baseline period (1961-1990).[34] The CCC (2009c) projections indicate that rainfall increases would be concentrated in the monsoon and post-monsoon periods, but rainfall would remain unchanged during the dry season relative to the historical record (ibid.: iii).
- **Tropical cyclone and storm surges** may rise (Giorgi et al., 2001: 606), with some increase in the area exposed to cyclones.
- The IPCC Fourth Assessment Report estimated that **global sea level rise** by 2100 may be in the range of 22—44 cm, with changes varying among regions by +/- 15cm

[32] A2 is a family of future emissions scenarios based on assumptions of: a world of independently operating, self-reliant nations; continuously increasing population; regionally oriented economic development; slower and more fragmented technological changes and improvements in per capita income (CCC, 2009c). A2 is one of four groups of emissions scenarios that underpin the main global climate modeling results used by the IPCC since 2000.
[33] See footnote 4.
[34] Rainfall during baseline period was 6.78 mm/d (deviation from - 2.18 to 1.92 mm/d) (CCC, 2009c: iii).

(Bindoff et al., 2007: 409). The Climate Change Cell calculates that, for Bangladesh, the higher end of this range could mean that by 2100 some 18 per cent of the country would be affected (Islam and Neelim, 2010: 12). More recent estimates suggest that global mean sea level rise could approximately double the IPCC AR4 projections (Richardson et al., 2009).

The regional scenarios developed by the CCC based on PRECIS were validated for 1989-2001 and 2000-06, reportedly with a high significance level (99%), and the derived correction factors were then used to develop the above projections for 2030, 2050 and 2070 (CCC, 2009c: 51). This work makes an important contribution to understanding how climate change may impact Bangladesh and different regions within it. Nonetheless, there are several limitations that need to be kept in mind, including: the use of data from several decades only rather than longer periods, the state of the art of global climate change modelling itself, and the fact that the Bangladesh forecasts are based on only one of the four families of emissions scenarios used by the IPCC.[35] As overall scientific knowledge and climate modelling techniques improve in future years, Bangladesh will need continuously to refine its own national and regional forecasts.

Secondary impacts associated with projected changes in temperature, precipitation, and sea level would affect livelihoods in Bangladesh in various ways. Increased rainfall, compounded by melting of glaciers in the Himalayas, would increase the incidence, intensity, and duration of flooding for communities living in floodplains. The extent of the increase would depend on where in the range of climate change estimates individual regions and communities find themselves. Poor communities that depend on agricultural livelihoods would likely see production decreases as a consequence of inundation in the short to medium term, followed by decreased water resources over the longer term as upstream glaciers shrink and disappear. Increased flooding would also cause higher rates of riverbank erosion, as most of the land in Bangladesh is comprised of soft alluvial soils that are susceptible to erosion by stronger river currents and more intense rainfall. The consequent loss of agricultural and homestead lands would increase landlessness and further impoverish already very low-income populations living in marginal areas, like *chars* and riverbanks.

[35] The IPCC Fifth Assessment Report (AR5), to be issued in 2014, will synthesize advances in scientific knowledge over the past few years and will update climate change ranges and forecasts. It will include four new sets of scenarios ("representative concentration pathways," or RCPs), based on different mitigation assumptions. These will complement the four families of emissions scenarios used to date by the IPCC (one of which is the A2 scenario used by the Bangladesh CCC for its forecasts; see footnote 32).

Freshwater resources in coastal areas would be impacted by increasing salt-water intrusion, affecting both the availability of safe drinking water and agricultural production in that region. While some investments in protective infrastructure may be technically and financially possible, for the most part rising sea levels will damage human settlements in coastal areas and cause increased out-migration to cities like Dhaka, exacerbating poor conditions of slums therein. Climate change is also likely to increase the incidence and severity of tropical cyclones, associated with increasingly stronger wind speeds and higher storm surges, potentially causing significant destruction to infrastructure and other economic assets along the coast, as well as to human settlements, leading also to loss of life and livestock. In addition to the effects of decreased safe drinking water, human health would be affected by an increase in some vector borne diseases, resulting from increased temperature and humidity, together with higher levels of congestion and poor sanitation (World Bank, 2010: 10; Cruz et al., 2007; CCC, 2009c; MoEF, 2009).

4.6.4. Implications for the Northwest region and fieldwork area

Gaibandha is one of the poorest and most disaster-prone districts in Bangladesh (World Bank et al., 2009). The principal climate-related hazards to which Gaibandha generally, and the fieldwork sites in particular, have always been prone include: (1) flooding, mainly from the Jamuna-Brahmaputra and Teesta rivers; (2) riverbank erosion, a secondary impact related to high currents from intense flooding and bouts of heavy rainfall; and (3) drought. These affect the lives and livelihoods of the communities living in Gaibandha in various ways, most directly through impacts on agriculture, health, and human development (the latter especially for children), and destruction of economic and other key assets (Ahmad, 2009; Ensor and Berger, 2009).[36] Taking into account growing evidence that weather patterns and extreme events have started to break with historical trends (Section 4.6.2) and the emerging projections of future climate change for Bangladesh (Section 4.6.3), this section reviews available knowledge on the implications of changes in climate-related hazards for the fieldwork areas in Gaibandha.

4.6.4.1. Changing climate-related hazard patterns in Gaibandha

Temperature increases observed for Bangladesh have in general not been as drastic in the Northwest of the country as in the coastal zone (Isalm and Neelim, 2010; Islam, 2009). On the other hand, the weather station nearest to Gaibandha, in Bogra, has reported the greatest temperature increase across the entire country, at +5.04°C over the last 100 years (Islam,

[36] Although cold spells also have serious impacts on livelihoods in some parts of Northwest Bangladesh, they were found to be less important in the fieldwork areas.

undated). In terms of **precipitation,** while historical volumes of rainfall have been higher in coastal and hilly regions than in floodplains and northern areas (Islam and Neelim, 2010), Shahid (2010: 5-6) finds that the maximum increase in annual rainfall between 1958 and 2007 was recorded in Northern Bangladesh (at a rate of 16.45mm/year); the maximum increase in monsoon rainfall was also observed in the North (11.15mm/year); and the Northwest region also shows a significant increase in pre-monsoon rainfall. The report concludes with potential positive and negative implications of these trends: "While increased monsoon precipitation may cause outbreaks of tropical diseases and increased incidence and severity of hydrological disasters, on the other hand, increased rainfall may help to keep groundwater levels in balance" (Shahid, 2010: 6). Asada and Matsumoto (2009: 29) find that "a trend of increasing rainfall may be partly responsible" for an increase in the effect of flooding on rice production over the last 40 years in the lower Ganges Basin (both in Bangladesh and West Bengal).

Patterns in the occurrence of **extreme weather hazards** have also shifted in the Northwest of the country: Rajib et al. (2008) found that in the Rajshahi-Rangpur region, while the incidence of moderate and mild **drought** has decreased over the last two decades as compared to the 1960-73 period, the incidence of severe drought has actually increased over the same period.

In relation to **erosion,** a hazard to which Gaibandha District is among the most vulnerable in the country, a study by Uddin and Basak (2012) finds that, on average, 256.1 ha of total land area was eroded each year in Gaibandha between 1973 and 2009, resulting in the erosion of a total of 9,220 ha of land over that period. This is equivalent to about 4.2 per cent of the total area of Gaibandha (217,900 ha). The authors conclude that the rate of erosion in the study area has been increasing in recent years, "because of climate change-induced intensifying rainfall pattern and unplanned interventions" (ibid.: 3).

4.6.4.2. Implications of future climate change for Gaibandha

The economy of Gaibandha is largely dependent on agriculture, the success of which, in turn, relies heavily on weather patterns. Geographically, the District sits in the floodplains of the Brahmaputra-Jamuna river system, which makes it highly vulnerable to alternating floods and drought. The *boro* crop is sensitive to drought, although the situation has been improved for those who have access to groundwater irrigation. Both *boro* and *aman* are affected by flood patterns: "if floods arrive early this will affect the harvesting of the *boro* crop while a late recession delays the transplanting of the *aman* crop" (Yu et al., 2010: 14). *Aman*, however, is more sensitive to flooding; during severe floods most of the crop can be washed away, and even regular, annual flooding can destroy *aman* in low-lying areas which tend to be inhabited by poor

communities who lack access to more secure and better quality land. Affected farmers attempt to replant their rice crops as floodwaters recede; however seedlings for replanting are in short supply, and are often again destroyed when floodwaters return (Ahmad, 2009: 28; Yu et al., 2010; Ninno et al., 2001; Biswas, 2005).

Besides destruction of crops, severe flooding or drought decreases the demand for agricultural labour, causing particular economic hardship for extremely poor households who lack the savings and resources to fall back on when earned income opportunities disappear. This happens annually during the two to three months between transplanting and harvest of the *aman* paddy crop, and can last longer depending on seasonal weather patterns. This means that under current conditions, there are only a few months of the year during which availability of agricultural day labour is certain, the main source of income for a majority of extremely poor households. Reduced crop production in the future would potentially translate into even fewer agriculture-based income-earning opportunities, increased uncertainty about the timing of these opportunities, and possible decreasing wages for agricultural day labourers, as the ratio of work opportunities to labourers becomes increasingly unfavourable. Due to already low levels of production in Gaibandha, together with current vulnerability of major crops to climate, communities in this area already suffer significantly from seasonal *monga*, and this could be exacerbated under accelerating climate change (World Bank, 2010).

Livestock and fisheries are also affected by natural hazards. Livestock suffer from lack of water during droughts, which increases their vulnerability to disease (ibid.). Disease also affects livestock if they spend prolonged periods of time in dirty floodwater that causes skin and other types of health problems. Fishing is an important livelihood activity for many extremely poor households in Gaibandha comprises another major livelihood activity for extremely poor households in Gaibandha, although primarily on a seasonal basis. Strong flood currents affect the availability of fish resources in the river and can be dangerous for fishermen, especially extremely poor people who often lack boats and proper nets (Ahmad, 2009; Biswas, 2005; World Bank, 2010).

Successive rounds of shocks—as well as slower onset stresses like drought—often act to entrench households in extreme poverty, while pulling others down into it. The effects of extreme events—like severe flooding and erosion—can be devastating for extremely poor households, and often cause the loss of all or most assets in one quick blow (Ahmad, 2009). Extremely poor households in Gaibandha have developed various coping strategies for dealing with natural hazards (see Chapter 7), but many of the coping strategies traditionally (and still)

used by them are based on knowledge and experience with historical weather patterns, which are now changing.

4.6.5. National policy approaches to climate change in Bangladesh

Bangladesh's official climate change policy was first articulated in its 2005 National Adaptation Programme of Action (NAPA), and subsequently in the 2009 Bangladesh Climate Change Strategy and Action Plan (BCCSAP). The six main themes of the BCCSAP are: (1) food security, social protection and health; (2) comprehensive disaster management; (3) protective infrastructure; (4) research and knowledge management on the timing and scale of climate change and associated hazards; (5) mitigation and low carbon development; and (6) capacity building for the public and private sectors, and civil society.

However, the issue of climate change and its possible impact on development had featured in many Government policy statements over the preceding three decades,[37] and much of public investment was directed to flood management, coastal polders, raising roads and highways above flood level, construction of cyclone and flood shelters, development of early warning systems, and research and dissemination of climate-resistant rice and other crops.[38] The objectives have been to make both the economy and individual households less vulnerable to climate-related impacts.

In recent years, the emphasis on community-level adaptation has been increasing, and Bangladesh is one of the countries participating in the global Pilot Programme on Climate Resilience administered by the World Bank. In 2009 the country established its own Bangladesh Climate Change Trust Fund financed by about US$100 million annually from its own national budget, and in 2010 created the Bangladesh Climate Change Resilience Fund which has so far received about US$125 million from international donors. In May 2012, Bangladesh also prepared a Rio+20 National Report on Sustainable Development. With regard to extremely poor rural people who are living in areas where they are particularly susceptible to climate-related hazards (e.g. *char* island and riverbank communities), the emphasis is on the creation of alternative livelihoods and strengthening social safety nets.

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[37] Among the other main policy statements or plans relevant to climate change are: the National Environment Management Action Plan (1994-95), National Land Use Policy (2002), National Biodiversity Strategy and Action Plan (2004), Integrated Coastal Zone Management Plan (2005), and National Plan for Disaster Management (2010).

[38] The Government estimates that about US$10 billion was invested for these purposes since the early 1980s (MoEF, 2009).

The Ministry of Environment and Forest (MoEF) is responsible for environmental policy, including climate change, but other ministries also are important, particularly the Ministry of Food and Disaster Management (MoFDM), and Ministry of Water Resources (MWR). A Climate Change Cell (CCC) was created in the Department of Environment (DoE), and a Climate Change Unit at ministerial level in MoEF. The CCC prepares technical papers for international negotiations, conducts training, supports research on climate change, and is overseeing development of a comprehensive Climate Change Database for the country. Bangladesh also has a set of well-respected think tanks and NGOs at the national (e.g. BCAS) and sub-national levels (e.g. GUK), that cooperate closely with the government on climate change analysis, strategy, and policy formulation, and are active participants in international climate negotiations and thematic forums.

4.7. Conclusions

This chapter provided a review of relevant secondary data in order to present socio-economic, poverty, and climate-related characteristics at the national level, in the northwest region, and within Gaibandha District and the *upazilas* and unions in which the respondent communities are located. This provides critical context setting for forthcoming empirical chapters on: the fieldwork sites, livelihoods among extremely poor respondents, perceptions of climate change, and coping and adaptive response in the two main field sites, Rajiapur and Bariakari.

Furthermore, the review indicates that while there has been considerable improvement in terms of economic growth, poverty reduction, improvement in human development indicators, and in the national approach to poverty reduction and addressing impacts from natural hazards the country has historically faced, there is a great deal of progress yet to be achieved. In particular, certain areas of the country, including the Northwest region in which fieldwork took place, have experienced disproportionately less progress. This area has also been the subject of less climate change research relative to other areas, like the coastal belt. These characteristics make the Northwest region, and Gaibandha District in particular, a suitable location for the study of climate-poverty-livelihood interaction.

Chapter 5:
Rajiapur and Bariakari field sites, socio-economic groups, and livelihood activities

5.1. Introduction

Most primary data collection for this thesis took place at two fieldwork sites in Gaibandha District. The two sites were communities in the villages of (1) Rajiapur (in Chandipur Union, Sundarganj *Upazila*), and (2) Bariakari (Kamarjani Union, Gaibandha Sadar *Upazila*). The first is located on a river embankment, the second on a riverine *char* island; both are among the poorest and most disaster-prone and climate-vulnerable areas in Gaibandha District. Fieldwork took place with the cooperation of these communities, between November of 2009 and September of 2010.

This chapter provides a general picture of life in the fieldwork sites, and specifically the nature of livelihoods of extremely poor respondents. It explores differentiation between the two sites and within them, and across the social and livelihood groups that comprise the core respondent groups. The chapter draws on primary data from all three phases of fieldwork (CVCA, household interviews, and life history interviews). Section 5.2 presents the overall village contexts in which respondent households reside; the data is drawn mainly from the village-level CVCA and includes village layout and communal resources; poverty; major livelihood activities; land use patterns; access to basic necessities like clean water and sanitation; and presence of NGO programmes, government safety nets, and unofficial community institutions, such as local mosque committees.

Section 5.3 presents findings from community-level participatory wealth-ranking activities, on the main socio-economic groups in the two field sites, including characteristics of the different wealth groups as identified by community members during the CVCA phase. This section provides insight into what it means to be rich, middle class, poor, and extremely poor, from the perspective of community members belonging to each of these wealth categories. Section 5.4 narrows the focus to the core respondent group of extremely poor households and individuals, reviewing their main livelihood activities and the climate-sensitive nature of these livelihoods. It also analyses what was found to be a primary defining feature of livelihoods in both field

sites—a high degree of diversification[39] at the level of both the household (with members involved in different kinds of activities), and individual, the latter characterized by the tendency to switch among livelihood activities throughout the year, depending usually on seasonal patterns and climatic conditions.

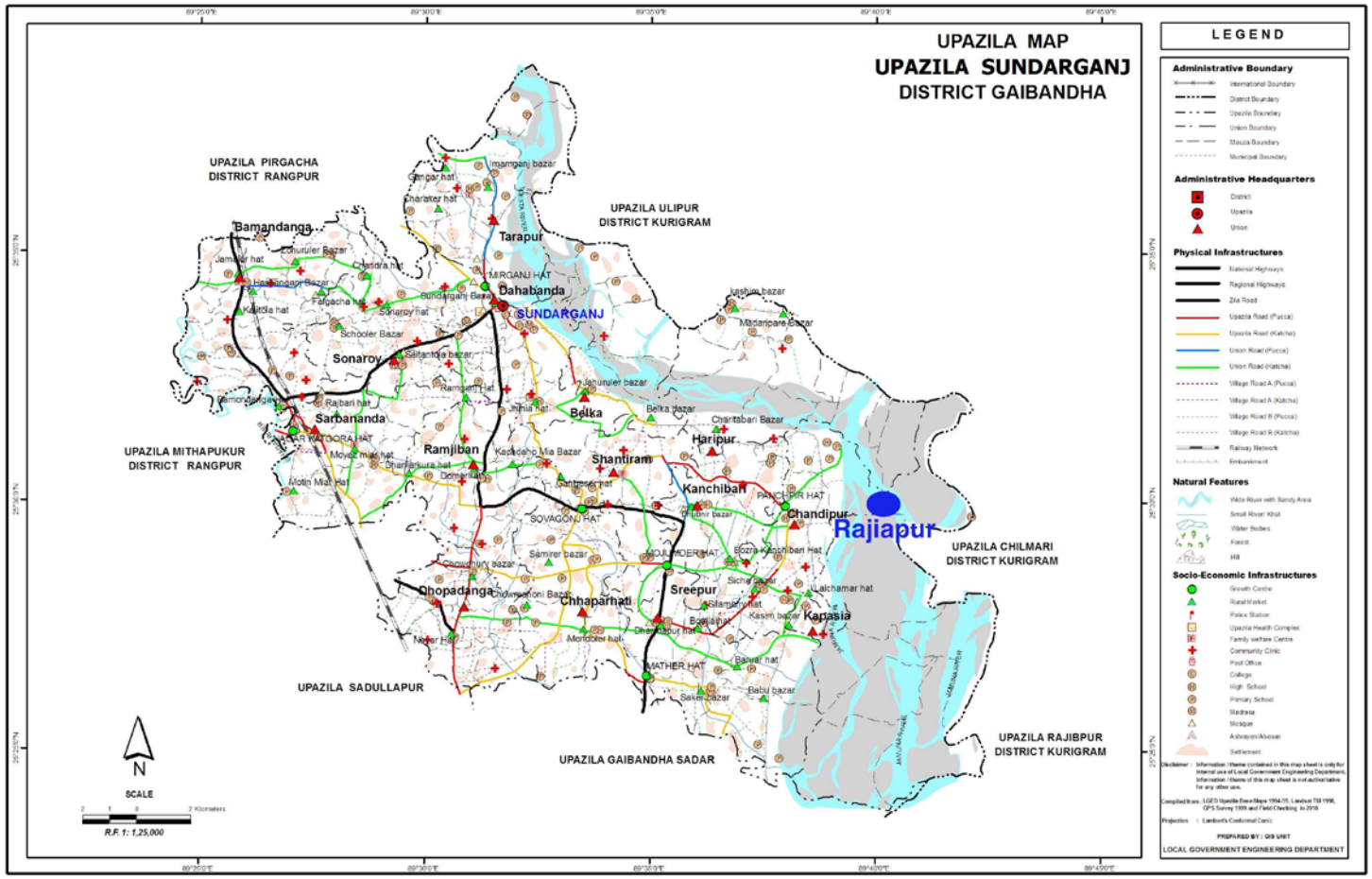
5.2. Introduction to fieldwork sites

5.2.1. Rajiapur

Rajiapur layout and communal resources. The fieldwork site is at the northeast edge of Chandipur Union, and comprises two *paras* in a village known locally as Rajiapur. The site is an embankment area, bordering the Teesta river to the north and east, and is slightly larger than 0.5 km in radius, extending back from the river and out on either side of the main road that runs directly through the middle of the village (Map 7).

[39] Ellis (2000: 3) defines diversification as "a diverse portfolio of activities and income sources amongst which crop and livestock production feature alongside many other contributions to family well-being."

Map 7: Rajiapur Village



(Source: GUK, 2012)

Approximately 2km to the west is an embankment that was built by the Bangladesh Water Development Board (BWDB). There had been a second embankment protecting Rajiapur from the river, but it was destroyed during a severe flood in 1998, and since then the community has been living on the land between the existing BWDB embankment to the west and the Teesta river to the east. Map 8 shows the CVCA participants' own depiction of their location.

Map 8: Rajiapur participatory community map

(Source: Rajiapur CVCA participants)

Approximately 3-4km to the west down the main road is the town, Pachpir, which has the nearest health clinic, shops, agricultural market for crops and livestock, and local NGO offices,

some of which work in the village. Within the village, there is one public primary school (Bochagari Primary School), one religious school (*madrasa*), a mosque, and a temple (all shown on the community map). The nearest high school is just beyond Pachpir, about 5km from Rajiapur. The main road running through the fieldwork site is government built (Rahamatpara Road), and there are approximately six other local roads, all unpaved. There is one *ghat*, or dock, located at the end of the main road on the river's edge, which is used to transport people and goods between *char* areas and the mainland. This provides transportation not only for the fieldwork community but also for people living in the surrounding areas, as far as Pachpir and beyond. There is no flood shelter in Rajiapur, however; when necessary, community members use one that is located approximately 2km to the south, in a nearby village called Kamarvita.

Demographics and poverty. The entire village of Rajiapur comprises about 250 households, split between Muslim and Hindu households that inhabit two separate *paras*, situated on either side of the main road. The poverty breakdown of the community is summarized in Table 13.[40]

Table 13: Results of participatory wealth ranking by Rajiapur Village members

Wealth category	Absolute number of households	% of households
Rich	10	4
Middle class	10	4
Poor	80	32
Extreme poor	150	60
(of which beggars)	(20)	(8)
Total	**250**	**100**

There are even numbers of poor and extremely poor households between the Hindu and Muslim *paras*, indicating that religion is not significantly correlated with poverty in the area.

According to participants in the wealth-ranking and community mapping activities, the literacy rate in Rajiapur is approximately 30 per cent; the other 70 per cent are either illiterate or can only sign their names.[41] Household interview data reveal that the overall literacy rate is lower among respondents than for the entire village and for Sundarganj *Upazila* generally: 22 per cent among respondents, 30 per cent for all Rajiapur, and 40.6 per cent for all Sundarganj (BBS,

[40] Determined by participatory wealth-ranking activities with village members across all socio-economic groups, and verified by GUK, a local NGO operating a livelihood programme in Rajiapur that targets extreme poor households.

[41] It is common in both field sites for illiterate individuals to know how to sign their names as a result of participation in NGO programmes or government safety nets that require participant signatures.

2011a). The literacy rate among female respondents is only half that of males (16 per cent female, 32 per cent male).[42]

According to participatory wealth-ranking, most children in Rajiapur aged 7-14 years, across all wealth categories and in both *paras*, either currently attend school or attended school for some period of time. However, among children from the respondent households, the drop-out rate is high, with the majority (31.5 per cent) attending only the first years of primary school (Class 1-2).[43] Seasonality is a factor, as it is common for respondent household children to miss school days at certain points throughout the year that correspond with severe flooding, or periods of food insecurity, during which time they engage in work on a temporary basis. This may be the reason why not a single respondent household currently receives the Education Stipend for sending their children to school.[44] Of a total of 42 children (up to age 14 years) in the respondent group, five report only working and not attending any school.[45]

Livelihood activities. The main livelihood activities in Rajiapur are: farming, either on one's own land, or through rental (*borgha*) or sharecropping (*adi*) arrangements; livestock rearing, including sharecattling; day labour, including on farms or fishing on someone else's boat; migration; maidservant work; rickshaw and van pulling (land transport); and agricultural trading, usually in the form of buying and selling crops and other goods, like fish, meat, and jute. According to village level CVCA data, non-poor households engage in farming on owned land on a larger scale than do extremely poor households, and they are also more involved in activities like agricultural trade (this is elaborated below in Section 5.3 on socio-economic groups in the two field sites).

Rajiapur households tend to have diversified livelihood portfolios, i.e. there is a tendency to switch among livelihood activities throughout the year, depending on seasonal availability of labour, which, in turn, is dependent on seasonal weather patterns. Seasonality affects some activities more than others, for instance the availability of jobs for agricultural day labourers is

[42] BBS has not yet published full Census 2011 details, which includes literacy by gender.
[43] These data echo findings from 2005 HIES (BBS, 2007: 88) that for both girls and boys, rates of primary school enrolment are significantly lower for children from households below the poverty line, and that dropout rates are particularly high among children from extremely poor households (ibid.; CARE, 2002).
[44] Bangladesh has been using conditional cash transfers in education since 1982. The current stipend for primary school children aims to reach the poorest 40 per cent of students. However, to be eligible, students must score at least 40 per cent on the end-of-year examination; if this condition is met, the payment is based on the number of months a student achieved an attendance rate above 85 per cent (Al-Samarrai, 2009: 217).
[45] The 2nd National Child Labour Survey (NCLS) found that 13.4 per cent of children aged 5-14 were working; about three-fourths of working children were males, one-fourth females. The majority were in agriculture (BBS, 2003).

sensitive to drought and rainfall patterns, since there is little irrigated land in Sundarganj *Upazila* (BBS, 2001).[46]

Land use. According to the community map created during the CVCA phase, about three-fifths of the land in the Rajiapur field site is used for agricultural production. Fertile land is concentrated further away from the river; the land closer to the river has been labelled by villagers as "not so fertile." The main crops grown in Rajiapur include *aman* and *boro* paddy, jute, wheat, pulse, mustard, and a variety of vegetables. Most respondent households do not own or have regular access to agricultural land, although a few are involved in sharecropping. Villagers believe that ownership of most of the agricultural land in Rajiapur is concentrated in the hands of about 10 families, the majority of whom live on the other side (i.e. to the west) of the BWDB embankment.

The other two-fifths (approximately) of land in the Rajiapur field site is used as homestead land; according to village level CVCA data, 150 of the 250 households (60 per cent) own their homestead land, with the other 100 households (40 per cent) living on other people's land. The latter households are concentrated closer to the river, and are highlighted in pink on Map 7. Interview data indicate that of the 26 respondent households in Rajiapur, 10 (or 38 per cent) own their homestead land, and 10 live on land belonging to someone else. The remaining six households own either half their homestead land[47] or are living on land belonging to family members. Among the respondent households that do not own their homestead land, none pay rent; landowners are largely absentee; and it is common in the fieldwork site areas to allow extremely poor households to occupy land in erosion prone areas without charging rent for at least the first year or two—after this period of time if the land has not eroded, the issue of rent is re-visited.

Water and sanitation. Tube wells are the main source of drinking water in Rajiapur. Being a flood-affected embankment area, raised tube wells are an important resource, although only a few exist, most belonging to rich households outside the immediate respondent household area. Half of the respondent households use a tube well that belongs to someone else (neighbours or family); this does not usually create conflict except during severe flooding, when all households rely on the same few tube wells that are raised above the flood level. Most of the tube wells are shallow (40-45 feet) rather than deep (60+ feet), which presents problems accessing water at

[46] This information is from the 2001 Census; there may have been an increase in the availability of irrigation in Sundarganj; however, data from the 2011 Census and the 2008 Agricultural Census was not yet available at this administrative level.

[47] Common among Hindu households in Rajiapur.

certain points in the year when the groundwater level decreases due to seasonal drought, compounded by simultaneous heavy use of irrigation for agricultural production.

There are approximately five sanitary latrines in the community, most belonging to wealthier households, with those belonging to poor and extremely poor households having been constructed as part of involvement in NGO programmes. Few respondent households in Rajiapur (15 per cent) have access to a sanitary latrine, with a majority (85 per cent) either using open places or constructing makeshift latrines using walls made from jutestick, which add only a degree of privacy. Access to sanitary latrines is lower among the Rajiapur respondent group than for Chandipur Union as a whole, across which 21 per cent of the population has access to a sanitary latrine (BBS, 2011b).

Housing. Whether houses are raised, and the durability of materials used in their construction, are extremely important in flood-prone areas. The condition of houses serves as one visual indicator of socio-economic status, as tin is more costly and durable than other materials, and jutestick or *shon* more vulnerable to rotting and destruction from floodwater, rainfall, and heavy wind during storms. The houses of poorer community members are generally constructed of less durable materials, and are not raised unless through participation in an NGO programme. They are closer to the river and therefore also more exposed to damage from flooding, erosion, and storms. Rich families tend to construct their houses entirely out of tin and bamboo pillars, with some also using concrete. Most extremely poor respondents try to save money over several months to purchase tin for construction of roofs; however those who are unable to afford tin instead weave pieces of polythene plastic in with jutestick to provide additional protection from leaks. This illustrates the correlation between poverty and higher degrees of exposure and sensitivity to climate-related hazards commonly cited in literature on social vulnerability to climate change (Brouwer et al., 2007; Fussel and Klein, 2002; O'Brien et al., 2007; Adger et al., 2007; Tanner and Mitchell, 2008).

NGOs, public safety nets, and community groups. Several NGOs operate in Rajiapur, including BRAC, Grameen Bank, Tangamar, ASA, and GUK. All but GUK operate exclusively micro-credit programmes. GUK runs a livelihoods programme for extremely poor households, Empowerment of the Rural Poor and Hard Core Poor (GUK, 2006), based on a graduation model (Orr et al., 2009; Hashemi and Umaira, 2011; Matin, et al., 2008) that offers two years of training and asset transfers to beneficiary households, followed by micro-credit as part of the second phase. GUK has also constructed a local community centre that provides information and services ranging from agriculture, to health, law, and disaster risk reduction training. Some government social safety nets (SSNs) operate in Rajiapur, and government public works

programmes are also periodically available. Of the SSNs, Vulnerable Group Development (VGD) is the most common among respondent households; under this programme beneficiaries are selected to receive a VGD card, which they show in return for disbursements of rice at different points throughout the year (Islam, 2011).

Preliminary results from the 2010 Household Income and Expenditure Survey (HIES, not yet available below Division level) indicate a substantial increase in the number of rural households receiving benefits from an SSN, from 15.54 per cent in 2005 to 30.12 per cent in 2010 (Islam, 2011: 4, 5). This rapid expansion in coverage is credited with contributing to rapidly dropping rates of rural poverty in Bangladesh (BBS, 2011b). However, the opposite trend of SSN access exists among the Rajiapur fieldwork community, where respondents report that far fewer of them receive some SSN today than did 10 years ago.

According to preliminary HIES 2010 data, the performance of different SSNs in terms of targeting extremely poor people is greatest for programmes like VGD and VGF (Vulnerable Group Feeding), with 31.7 and 36.1 per cent of recipients belonging to the 'lowest extreme poor quintile,' respectively (BBS, 2011b: 6). For respondent households currently receiving the VGD card in Rajiapur, 100 per cent of recipients are extremely poor, based on the community wealth ranking. However, there are also large numbers of uncovered extremely poor households. This finding possibly reflects the local reality reported in the HIES that, while SSNs are "reasonably well targeted, the poverty incidence of the population not included in SSNPs in Rangpur (37.6 per cent) and Barisal (33.5 per cent) are higher than national average poverty incidence. SSNPs are therefore reaching the poor but not all the poor everywhere" (BBS, 2011b: 5).

Government flood relief is reportedly distributed to all households in Rajiapur during severe flooding. CVCA data suggest that every household receives something in these instances—usually 2–3kg of rice, distributed once or twice during the flood season; however, household interview data indicate that only 85 per cent of respondent households have received government flood relief in the last 5 years. Villagers assert that households who can afford to bribe local government officials receive larger amounts (5–10 kg and more). GUK is the only NGO that currently distributes flood relief in Rajiapur, also mainly during extreme floods, and this comes in the form of a package including food (rice and pulse) and other goods like soap, oil for kerosene lamps, and water purification tablets. These packages are distributed to households whether or not they participate in the GUK programme, although beneficiaries are more likely to receive flood relief than are non-beneficiaries.

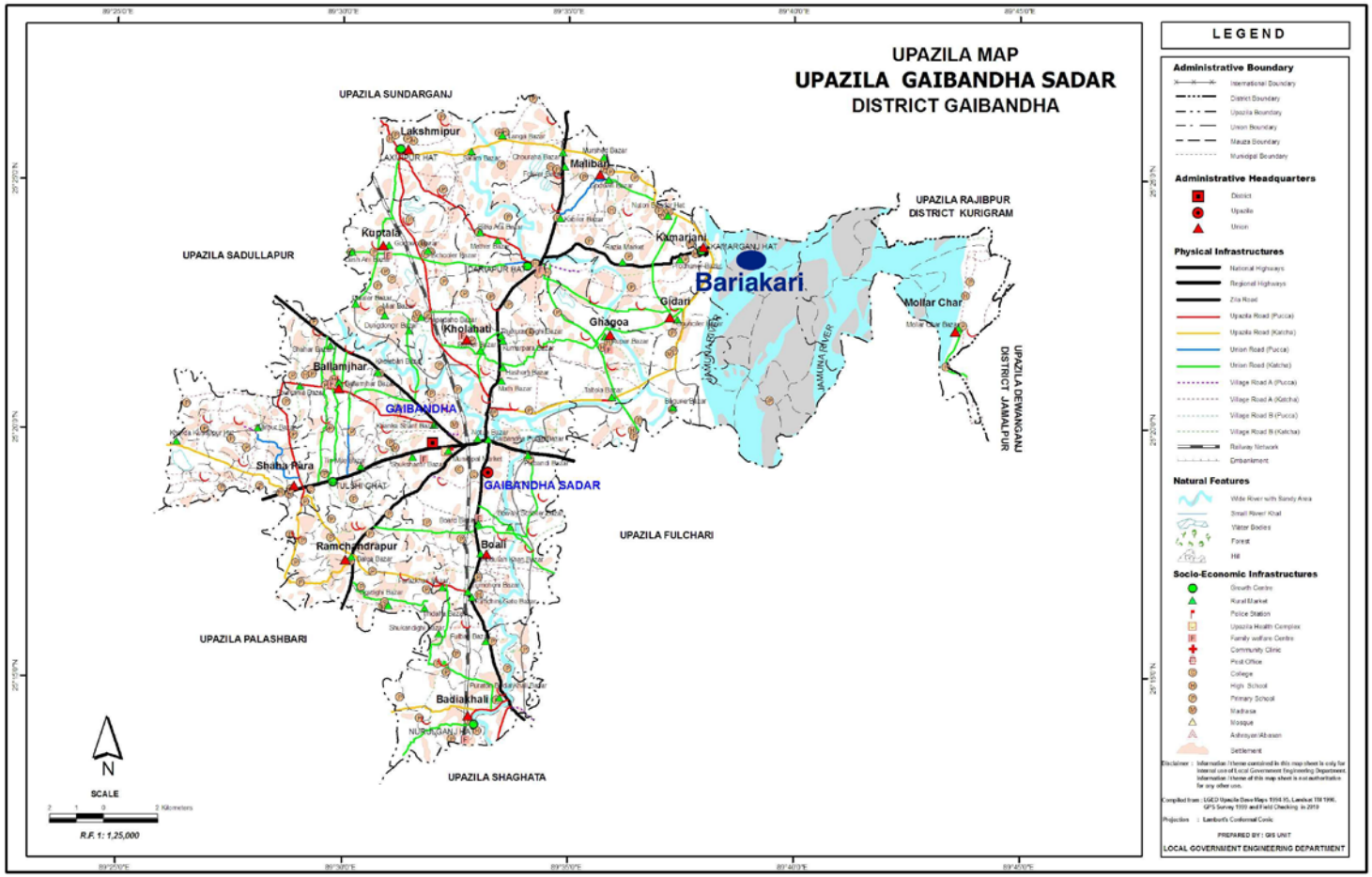
According to institutional mapping exercises undertaken during the CVCA phase, the following community-based groups exist in Rajiapur: a Mosque Committee, a Moharam group, and a Puja group. The Mosque committee is extremely important for Muslim community members, fulfilling leadership roles within the *jama't* (the local Muslim congregation) (Bode, 2002). The Committee includes less than 10 members in Rajiapur, none of whom come from respondent households; they are all men (by requirement) and are generally from locally respected and very religious families. These members are extremely influential, often settling disputes between community members. The Committee is also responsible for collecting funds from the community for the upkeep of the mosque, repairs when needed, and payment for *madrasa* teachers and *Imams*, who are also appointed by Mosque Committee members.

In cases where the mosque is damaged as a result of climate-related hazards (floods or erosion), it is considered extremely important for community members to contribute to repairs, and most do so. The Mosque Committee also takes part in organizing some religious events. The Moharam group is temporary, and comes together before the Muslim holiday of Moharam to help organize the related celebrations. For Hindus, the Puja group is similar, although forms on an intermittent basis throughout the year in the lead up to Hindu holidays and religious celebrations in order to collect money for and organize the celebrations. Membership is open to both men and women. In discussing religious, community-based groups in FGDs during the CVCA phase of data collection, community members made it clear that these organizations are of utmost importance to their spiritual well-being, and are considered far more beneficial to them than NGOs or micro-credit organizations.

5.2.2. Bariakari

Bariakari layout and communal resources. Bariakari is a riverine island *char*, located in the Jamuna River in Kamarjani Union. It is represented by a blue dot on Map 9:

Map 9: Bariakari Village

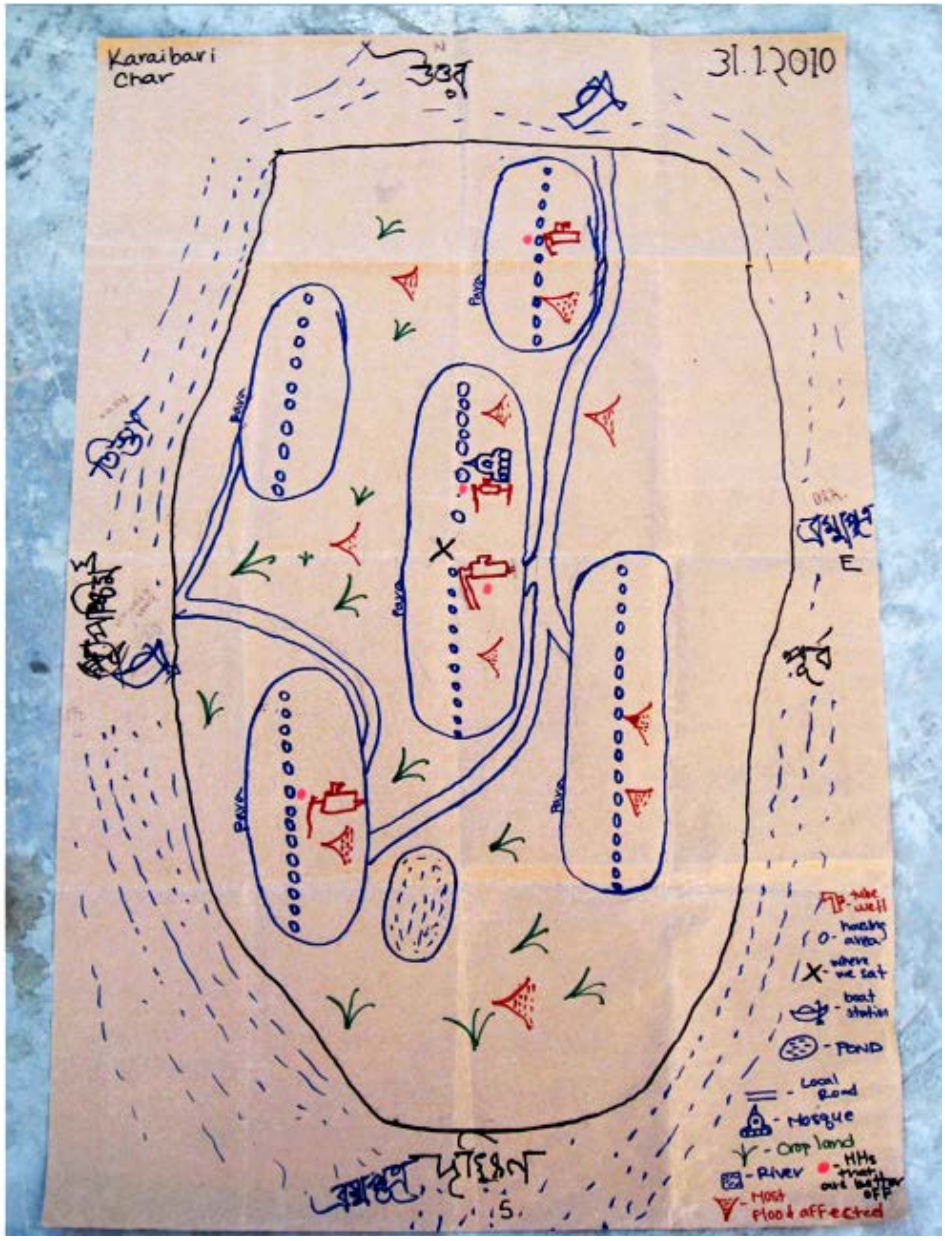


(Source: GUK, 2012)

As a *char* island, Bariakari is particularly vulnerable to flooding, riverbank erosion, and drought (Kabir, 2006; Ahmad, 2009). According to many inhabitants, Bariakari is considered a newly formed *char*; older village members, however, describe having lived on Bariakari in the past, indicating that it is actually a re-emerged *char* that existed approximately three decades ago before major erosion made it uninhabitable. It subsequently re-formed in recent years, and some inhabitants have returned to re-claim previously owned homestead and agricultural land.

The community living in Bariakari is spread over four *paras*, named for their positioning on the island—North (*Uttor*), Middle (*Modhom*), South (*Dakkhin*), and West (*Poschim)*. The *paras* are shown as separate ovals below, on Map 10, created by the community during participatory community mapping at the beginning of CVCA data collection.

Map 10: Bariakari participatory community map



(Source: Bariakari CVCA participants)

Five *paras* are shown on Map 10, however in subsequent CVCA activities conducted following the construction of the community map, villagers and core respondents agreed that most Bariakarians recognize only the four *paras* named above.

There are few collective resources in Bariakari: three local roads, all unpaved; one mosque, although by the time fieldwork ended the community was constructing a second; and two *ghats*, or docks, one on the north side of the island and the other on the west. These are serviced by both public transport boats that travel according to regular schedules between Kamarjani mainland and various *char* islands, as well as by local boats. The latter are owned by

community members in Bariakari or nearby *chars*; they charge fees to transport people and goods (e.g. to nearby markets) but operate more according to the needs of the local community. Boats to the mainland provide the only connection to markets, health clinics, veterinary services, schools, and flood shelters, as none of these exist on Bariakari, with one exception. Near the end of the fieldwork period, in August 2010, a school-cum-flood centre was built in Bariakari by an NGO operating in the area. It was constructed on a patch of land in Middle *para* that had been raised by a separate, *monga* eradication food for work programme organized by the local government.[48] When fieldwork concluded in September 2010, the building had not yet begun to be used as a school, as it was still being used as a flood shelter, mainly to house community members' livestock. Some nearby, more established *chars*, do have schools and flood centres that Bariakari villagers access.

Demographics and poverty. At the time fieldwork began, there were a total of 145 households on Bariakari *char*. The respondent group is comprised of 15 households in total, seven households from North and Middle *paras* (these two are also often thought of as one *para*, as they are very close together and were inhabited at the same time. For this reason, henceforth the two are combined under the name North *para*), four from West *para*, and four from South *para*. Unlike the Rajiapur community, all of the households in Bariakari are Muslim. Due to uneven rates of soil accretion and erosion on different parts of the island, North *para* is older, having risen somewhere between eight and 12 years ago, and therefore has more inhabitants than South and West *paras*. South and West *paras* rose over the last three to four years, with resident households inhabiting the area no more than two years ago (i.e. between June and September 2009).

This provides a dual character to the Bariakari community: the households in South and West *paras* reflect the nature of coping and rebuilding of livelihoods for those individuals recently affected by erosion and flooding (between six and eight months prior to the beginning of the fieldwork for most respondents in these *paras*). In contrast, a greater number of households in North *para* had been affected by erosion and forced to relocate between eight and 10 years ago, and have therefore had relatively more time to re-establish their livelihoods. This difference is easily visible, as North *para* is generally characterized by better quality housing, greater numbers of livestock, more tube wells and sanitary latrines, and more homestead land that is raised above the flood level.

[48] The school-cum-flood centre is not shown on the community map, since it was constructed several months after the map was created.

This division is also evident in the poverty breakdown: all but two of the rich and middle class households on the *char* live in North *para;* the poor and extremely poor are evenly spread across the entire *char,* except that all but two of the households classified as the poorest of the poor (beggars) are in South and West *paras.*

Table 14: Results of participatory wealth ranking by Bariakari Village members

Wealth category	Absolute number of households	% of households
Rich	19	13
Middle class	0	0
Poor	40	28
Extreme poor	86	59
(of which beggars)	(12)	(8)
Total	**145**	**100**

Overall, the literacy rate for Gaibandha Sadar is 47.5 per cent (BBS, 2011), but this is influenced by the fact that the main urban centre of Gaibandha is located in this *Upazila.* For Bariakari, CVCA data suggest the level on the *char* is about 25 per cent, and household interview data indicate about 21 per cent for the respondent group. Unlike in Rajiapur, the literacy rate among core respondents in Bariakari is the same for males and females.

A majority of the children in Bariakari did not attend school throughout the fieldwork period, although children from most respondent households had attended school before relocating to Bariakari following erosion on a neighbouring *char,* where almost all respondents had lived before moving to Bariakari. Thus the school drop-out rate is even higher in Bariakari than in Rajiapur, with 100 per cent of the children (up to age 14) who attended school at some point dropping out by class 2. This is echoed by findings from Kabir (2006) and MoEF (2012) on the state of education on *char* islands in Gaibandha.

There is a primary school on the nearest mainland area of Kamarjani (Karaibari Government Primary School), as well as primary and high schools on nearby *chars* (Vati Kamari, and Kunderpara), however most respondent households were unable to afford the boat fees (10 *taka* round trip) to send their children to school on a regular basis. In addition, fees for school materials and exams exceed what most respondents on Bariakari can afford. According to village level CVCA data, approximately 30 households in Bariakari do manage these costs, although most of them are among the non-extreme poor, from North *para.*

According to information collected by GUK (Islam, 2012) after the completion of fieldwork in 2010, three respondent families have been receiving the Education Stipend for sending their children to the Karaibari Primary School in Kamarjani. Two were identified (both self-identified and by peers) as extremely poor. The third family both considers itself less poor than others in the respondent group, and is classified as being at the higher end of the extremely poor group by participatory wealth ranking. This suggests that the Education Stipend is covering the costs of materials and travel (for the extremely poor households). On the other hand, the other 12 households among Bariakari respondents are not benefiting, indicating insufficient coverage, and one household that is considered rich, and is headed by an ex-member of the local government, is receiving the benefit, suggesting possible leakage and/or corruption. In addition to the schools listed above, the *Imam* in Bariakari provides lessons for children in the mosque, although this is on an occasional and irregular basis. In Bariakari, many children (aged 15 and under)—both boys and girls—engage in some sort of work, usually unpaid and within the household: seven out of a total of 23 children from respondent households help rear animals that their parents either own or share cattle, and two children work for income, doing agricultural day labour.

Livelihood activities. The main livelihood activities in Bariakari include crop agriculture (farming, sharecropping, agricultural day labour), fishing and river transport, livestock, construction, and migration. Agricultural activities predominate, reflecting the wider pattern in Gaibandha and Rajshahi-Rangpur (BBS, 2008, 2011b). Most households in Bariakari are involved in some production of crops, although this is on a smaller scale for poor households. As in Rajiapur, there is a great deal of diversification across households and individuals, who tend to engage in various activities throughout the year based on seasonal availability of work.

Land use. The majority of land in Bariakari is used for agricultural production, and the main crops are maize, groundnut, jute, and *dhuncha* (a local crop similar to jute). *Boro* and *aman* paddy varieties, oil seed, and *chena* (a grain that is mixed and eaten with rice) are also grown but on a much smaller scale. Maize has become the main cash crop in recent years, and a variety of vegetables are also grown on homestead land, but mainly for consumption. Rates of homestead land ownership are low in Bariakari: not a single respondent household owns the land on which it currently lives; a majority of households (53 per cent) live on land they do not own and pay no rent. The remaining households live either on land owned by a family member, pay rent to the landowner, or are in conflict over the ownership of their household land (one respondent household). Some 10-15 families reportedly own all the land on Bariakari, although most live in surrounding mainland areas.

Water and sanitation. Similar to Rajiapur, the main source of drinking water is tube wells, but lack of a sufficient number of them is a major problem according to the villagers. In South *para*, for instance, there were no tube wells at the beginning of the fieldwork period, although by the end there were four, so this problem eased progressively throughout the course of fieldwork. In West *para*, there was just one tube well for the entire duration of fieldwork, belonging to the only two rich households living in that *para*, although all other households were permitted to use these. In North *para* there were significantly more tube wells from the onset of fieldwork, given the longer period of residence on the *char* of the North *para* community.

What is lacking in all *paras* where respondents live—although to a lesser extent North *para*—are enough tube wells raised above the flood level, a critical resource given how low lying the entire Bariakari *char* is. When asked to list the greatest challenge to their livelihoods, several respondents in Bariakari mentioned lack of access to tube wells, whereas none did in Rajiapur. When tube wells are unusable, community members often drink river water that they do not always boil. Drinking river water during flood season is a particularly serious health hazard, as the river becomes highly contaminated. Another strategy common among respondents in Bariakari is to collect drinking water from 'shallow water machines:' agricultural machines that pump groundwater for irrigation. These, however, are normally used to source drinking water only during the maize season, when sharecropping respondents rent them from richer households to irrigate crops.

In terms of sanitation, during initial fieldwork in Bariakari, there were three sanitary latrines in North *para*, one in West *para*, and none in South *para*. The three households with sanitary latrines in North *para* had received these from DFID's *Chars* Livelihood Programme (CLP), having previously been beneficiaries of the programme on other *chars* before moving to Bariakari. Similar to tube wells, the households owning sanitary latrines often allow neighbours to use them, however the entire respondent group in Bariakari reports using either a makeshift latrine (with jutestick walls, for privacy) or open places. This is significantly lower than the average rate of access to sanitary latrines across all of Kamarjani Union, which is 37.7 per cent (BBS, 2011) and among Rajiapur-based respondents (15 per cent).

Housing. Housing materials in Bariakari are similar to those used by respondents in Rajiapur, and thus are similarly sensitive to extreme weather; most homes are constructed of a mix of jutestick, *shon* (a local crop similar to jute), and tin—with the walls usually made of the former materials and roofs of tin, all supported by bamboo pillars. The homes of four respondent households are raised above the flood level; three of these are in North *para* and were raised by CLP; one is in South *para*, and was raised by the respondent family.

NGOs, safety nets, and community organizations. Important programmes in Bariakari include DFID's Chars Livelihood Programme (CLP) (which is implemented by GUK), and a programme run by an NGO called Lifebuoy. The latter NGO constructed the school-cum-flood shelter in Middle *Para*, and has also committed to providing school supplies and a teacher once classes begin. Lifebuoy also uses participatory wealth ranking methods to select between three and five extremely poor households each year, to whom it provides better quality housing and a tube well. This NGO also sends a doctor to Bariakari once a month and provides annual flood relief. Separate from CLP implementation and the savings group, GUK also provides flood relief to Bariakari during severe flood years.

The local government periodically runs earth raising public works programmes on Bariakari and surrounding *chars*, such as the aforementioned *monga* eradication programme that raised the land on which Lifebuoy constructed a school. The most commonly reported SSNs in Bariakari are the VGD card and Widow's Allowance. In terms of change in SSN access over recent years, a similar pattern to Rajiapur emerges in Bariakari, whereby fewer villagers report receiving SSN benefits now than in the past.

During severe floods, most villagers report receiving some government relief in the form of rice. Most people receive between 1–4kg while some households report receiving slightly more (5–10 kg). Unlike in Rajiapur, there were no reports of bribing government officials to gain access to greater amounts of flood relief. Most individuals involved in NGO programmes also report receiving flood relief from these NGOs. In terms of unofficial groups, there is only the Mosque Committee, since all community members are Muslim. No members of the respondent group in Bariakari are part of the Mosque Committee, which performs the same functions as the Mosque Committee in Rajiapur, described in Section 5.2.1 above. Similar to in Rajiapur, community members in Bariakari indicated during institutional mapping exercises that the groups that are most important for their lives are the religious groups, followed by NGOs.

5.3. Socio-economic groups in Rajiapur and Bariakari

The following sub-sections summarize findings on the characteristics of the socio-economic groups in the two villages: rich, middle class, poor, and extreme poor.[49] In general, the four groups are distinguished by their financial and productive resources (e.g. land, livestock), extent of livelihood diversification, access to basic amenities (clean water and sanitation), food security, ability to educate their children and meet household health needs, and nature of relationships and networks. They are also differentiated by their relative vulnerability to climate-related shocks and stresses in several ways:

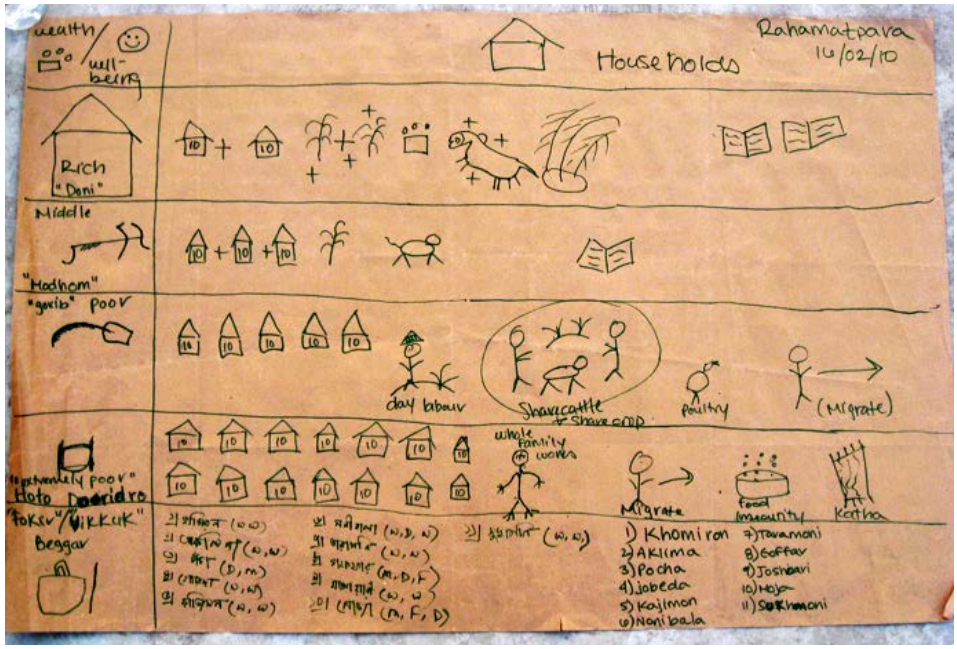
- The extent to which homes are exposed to extreme events, for example flooding and erosion, by virtue of their proximity to the river;
- The sensitivity of their homes to wind, rain, storms, and other adverse weather as a result of the durability of the materials used in their construction;
- Their access to secure and/or non-natural resource dependent jobs;
- Their ability to access government safety net programmes, especially those designed to help in coping with climate-related shocks and stresses (e.g. flood relief).

In carrying out the participatory wealth-ranking exercises, including one in Rajiapur and three in Bariakari (one for each *para*),[50] participants developed drawings to illustrate the characteristics they associated with each of the socio-economic groups. Since many participants in the wealth ranking activities were illiterate, symbols were used to represent each socio-economic group, as well as the resources and livelihood activities pertaining to each. As an example, Figure 4 is the one completed in Rajiapur.

[49] As described in Chapter 3, Section 3.3.1, the data presented here on the characteristics and experience of being extremely poor were initially identified during participatory wealth-ranking exercises, then further elaborated during household and life history interviews with individuals from the extremely poor core respondent group. Data on what it means to be rich and/or middle class in the field sites were gathered primarily from participatory wealth-ranking exercises, since non-poor individuals were not included in the core respondent group.

[50] Middle and North *Paras* were covered in a single wealth-ranking exercise since the former *Para* is very small, and the households in these two neighbourhoods inhabited Bariakari at roughly the same time and therefore know each other well.

Figure 4: Participatory wealth-ranking for Rajiapur Village



(Source: Participants in Rajiapur, participatory wealth-ranking)

Rich ('doni') Wealth-ranking activity participants in both Rajiapur and Bariakari selected a large tin house as the image to represent households in the rich category. Rich families also tend to have more than one house, which, in addition to being constructed out of more durable materials (sometimes also including concrete, although this is more common in towns), are also well maintained and therefore usually in visibly good condition, repaired immediately if damaged by extreme weather.

Rich households, by definition, have more money and usually own the land on which their homesteads are located. They tend not to live in erosion and flood-prone areas, and the households considered rich in both fieldwork sites are located on raised, better quality land compared to poor and extremely poor households. It is also common for rich households to own a private tube well and sanitary latrine, and often a bamboo garden (although this pertains only to rich households in Rajiapur as there were no bamboo gardens in Bariakari), the bamboo from which is used both to construct houses and sold for additional income.

Rich individuals have greater access to work opportunities that are non-natural resource-dependent than do their poor and extremely poor counterparts, although this is more the case in Rajiapur, as this is a mainland area with better physical links to non-farming income-earning opportunities. Examples include involvement in business in some capacity, or holding a government position, for instance with the police, army or Border Guard of Bangladesh (BDR), or as a schoolteacher or Union Parishad (UP) member. In Rajiapur, being rich is also associated

with owning large amounts of agricultural land, while rich households resident on Bariakari generally rent land from absentee landowners, usually large amounts and for the entire year. Rich households in both locations also have enough liquid savings to engage in '*bandhak*' on a large scale. Whether through ownership or rental, rich households in both field sites cultivate enough crops to meet their own food consumption needs for the entire year, usually with enough surpluses to also sell part of the production. Rich households also tend to own agricultural equipment, like shallow water machines for irrigation, and usually own livestock, rather than engaging in sharecattling, which is often the basis on which poorer households have access to livestock. The children of rich households are almost always in school (albeit less so in Bariakari, given the lack of a local school), and do not engage in work outside their homes for income.

In terms of how rich households experience climate-related shocks and stresses, respondents explain that while rich households have more resources at risk of becoming damaged by adverse weather, they also have more resources with which to recover and rebuild their livelihoods. This includes savings to fall back on if crops are destroyed, resources to rent boats to move possessions to higher land during floods, and/or to buy land elsewhere before erosion affects them seriously.

Finally, respondents report that rich (as well as middle class) individuals are often more powerful, benefiting from personal relationships with locally influential men and government officials. This often allows richer and more powerful households access to government jobs, which are highly sought after for their reliability, as well as SSNs. For instance, Natib, a non-respondent living in Bariakari, receives 100 *taka* per month for each of his two children through the Education Stipend Programme, even though he is rich by local standards. He is also an ex-member of the local government, which is reportedly why he receives this benefit, intended for poor households.

Middle class ('modhom') households in Rajiapur and Bariakari have many of the same resources as rich households, but in lesser quantities. This is reflected in the symbol chosen by one of the wealth-ranking groups to represent the middle class: a smaller tin house. Like rich households, middle class households usually own their homestead land, which tends to be located in less exposed areas than that of poorer community members, i.e. not directly on low-lying land next to the river. Middle class households in Rajiapur usually own agricultural land,

or rent in Bariakari, but in smaller amounts than rich households (5–10 *bigha*[51] as opposed to 20–25 *bigha* for rich households) and are able to feed themselves from the yield this produces for only about six months rather that for the entire year, buying food (albeit comfortably able to do so) for the other six months. In terms of other resources, middle class households also tend to own livestock, but fewer head relative to rich households, especially cattle, which are the most expensive and lucrative animals. Middle class households also usually have their own tube wells and sanitary latrines, although, like their rich counterparts, often allow fellow community members access to these. Children from middle class households (again, more so in Rajiapur than in Bariakari) attend school regularly, as these families can afford the fees for tests, as well as for school supplies.

The most common occupation among middle class households in Rajiapur and Bariakari is farming. Some are also involved in non-agricultural livelihoods (e.g. business and/or government jobs), and a minority group among the middle class are involved in sharecropping. Most, however, own at least some agricultural land or are able to rent land for cultivation regularly, and none are day labourers. No middle class households (nor rich) need to engage in migration as a livelihood. As a result of greater ownership of or access to income-generating resources (i.e. agricultural land, livestock) and access to better jobs (including non-agricultural work and government positions), these households are generally able to make a good living locally. Middle class and rich households also do not experience seasonal unemployment or food insecurity (*monga*).

Similar to rich households, middle class households also tend to have close relationships with locally powerful men and members of local government, as well as the financial resources to bribe government officials in order to gain access to safety net resources. Men with political connections often benefit by acting as intermediaries between NGOs/donors, local governments, and communities. As a first step in selecting beneficiaries for anti-poverty programmes and safety nets, the NGO/donor/government visits all households and conducts a survey, from which extremely poor households are identified. This initial list is then handed over to intermediaries or ‘middle men,’ who are asked to verify the list. They often demand bribes from the community, adding and cutting names depending on who pays. This middleman role was observed in both fieldwork communities, most often filled by men from rich or middle class households.

[51] A *bigha* is a unit of land measurement, which in Gaibandha is equivalent to about 20 *katha* or 33 decimals of land, or about 0.2 acres.

For all these aforementioned characteristics—especially greater access to less climate-sensitive livelihoods, more financial resources, better quality housing in less exposed areas, and political connections—middle class households, like rich, in Rajiapur and Bariakari, tend to have an easier time coping with weather-related events. The children from rich and middle class households are also generally less affected by weather-related events than their poorer counterparts. For instance, between the months of May and September/October, schools are often closed in the two fieldwork areas, both because of school buildings being flooded and because schools that are on raised land are often used as makeshift flood shelters. This means that children miss a great deal of school at this time of year. However, according to interview data, children from families with sufficient resources are able to make up missed lessons by visiting private tutors, which is costly, and therefore a practice common only among better-off households, although this is reportedly more common in Rajiapur than in Bariakari.

Poor ('gorib'; 'din mojur' or kom gorib) The symbol used to represent poor households in most wealth-ranking exercises was a *kathay,* which is a tool used by agricultural day labourers to harvest paddy. This represents one of the defining features of being poor (and extremely poor) in Rajiapur and Bariakari: dependence on day labour. While this includes day labour that is either farm or river-based (i.e. working as a fishermen, or boatman), the former is the most common type of day labour in which respondent households that self-identify as poor engage. Poor households sometimes own their homestead land, but usually not agricultural land. Involvement in some kind of cultivation is common, most often through sharecropping or land rental. This is usually only for a few months of the year, as cultivation requires financial investment, and is largely to meet the household's own food consumption needs. Sharecropping usually only provides food for poor families for about three months a year, and is more common among poor households in Bariakari, where land is more plentiful and the population density is lower than it is in Rajiapur. The experience of *monga*, usually lasting about three or four months a year, is another defining feature of poverty in both field sites, due to lack of work between planting and harvesting seasons of major crops (e.g. paddy, maize), as well as the impact of weather (e.g. floods) on agriculture during some seasons (Khandker and Mahmud, 2011, 2012; Khandker, 2012; Conroy and Marks, 2008; Zug, 2006).

Migration has become an increasingly common and important livelihood activity for poor households in Rajiapur, both as a coping response during *monga* periods and increasingly as a primary livelihood activity,[52] as local work opportunities in agricultural day labour have

[52] This trend is echoed in literature on changing migration patterns in Rajshahi Division, e.g. CARE (2002, 2005) and Zaman (2006). SIPP (2004: 26) also indicates that migration has become common in Gaibandha District, with 25.8 per cent of the labour force migrating to other areas for work in 2003.

declined due to increasing population (especially in Rajiapur) and loss of agricultural land to erosion.

Ownership of cattle is rare among poor households, except for those who have received these as asset transfers through involvement in NGO programmes. Access to cattle through sharecattling arrangements is much more common for poor households, for whom this provides an important source of income. This also extends to other animals, like goats and sheep. Poultry are less expensive and therefore more commonly owned by poor households. In terms of access to basic amenities, poor households tend not to own tube wells or sanitary latrines, but often share these with other households or access communal ones installed by the local government or NGOs.

Children from poor households attend school, but at lower rates than their non-poor counterparts, and sometimes for only a few months out of the year, due to the inability to afford school supplies and fees for exams. Children from poorer households also engage more in paid work outside the household, sometimes as maidservants living in employer's houses (girls), or rearing sharecattle for their families (both girls and boys). Poor and extremely poor households generally have a harder time coping with weather-related events. Their houses are often constructed of less sturdy materials, and are located in more exposed areas (directly on riverbanks). Incomes from day labour are also very low,[53] meaning poor households cannot accumulate enough savings to fall back on during periods of seasonal unemployment in agriculture. Instead they either cope by having some family member(s) migrate to other districts for work, or borrow money on interest from local moneylenders (see Chapter 7). Poor households also often lack the education and/or skills to access non agriculture-based work, or the financial resources to engage in agriculture on a larger scale. All of these factors make poor households more vulnerable to a range of climate and non climate-related sources of risk and vulnerability (See Chapter 6) as well as less able to cope with extreme weather and climate-related hazards when they occur.[54]

While political connections are more common among better-off households (rich and middle class), a few poor households also enjoy them. Zahir, a self-identified poor respondent in Bariakari, has a friendship with the local government chairman, because they grew up in the

[53] According to a poverty mapping exercise carried out by the World Bank, BBS, and WFP (2009), wages for agricultural day labour in Gaibandha are on average 39 *taka* and 60 *taka* per day, with 99-144 *taka* comprising the parameters of highest category. While these figures do not include food, which often comprises part of payment for daily wage labour in Gaibandha, they are among the lowest wages for agricultural day labour in the country. SIPP (2004) also reports extremely low average daily incomes for day labour in Gaibandha, at 80 *taka/*day at that time.

[54] This finding is echoed by literature on the difficulty poor and extremely poor households face in accessing tangible and intangible resources for coping with shocks (Sen, 2003; Krishna, 2010).

same village. This has likely afforded his household access to periodic disbursements of food via access to a VGD card, and his deep tube well was a gift from the chairman. Zahir's household therefore was able to acquire both a means of storing food to eat during periods of seasonal lack of work, and access to water throughout the year, since the water pipe was long enough to not be affected by reduced water tables during the dry season. Both of these also benefit Zahir's neighbours in Bariakari, as he allows other community members access to the tube well through the year, and engages in an unofficial community safety net, called *dhar koroj*, through which community members borrow and lend each other small amounts of food and money as needed throughout the year. Zahir's story, however, was the exception, rather than the rule, in terms of poor households having personal relationships with members of local government.

Extreme poor ('hoto doridro'; 'niriho gorib'; 'besi gorib') The defining features of extreme poverty in Rajiapur and Bariakari, as identified consistently by fieldwork respondents are: complete landlessness, i.e. families and individuals who own no land at all, not even that on which their homesteads are built; victims of riverbank erosion—those who have lost all or most of their possessions and livelihood resources either once or several times; and those who depend entirely on day labour for their livelihoods throughout the year. Extremely poor households lack homestead land, but do generally have homes, although these tend to be located on the lowest lying and poorest quality lands, and are therefore highly exposed to hazards like flooding and riverbank erosion. Many of the poorest respondents had lost homestead land they previously owned (erosion being the most common cause in both fieldwork sites), and been forced to inhabit whatever land they can find, which tends to be in locations where nobody else wants to live. Furthermore, they lack the resources to use durable materials in constructing their homes, like tin and concrete, and instead most often use a combination of jutestick and *shon*, which are extremely sensitive to weather-induced damage. In terms of access to basic amenities, extremely poor households tend not to own tube wells, instead using those belonging to others, or communal tube wells installed by NGOs or the local government, which are sometimes located far distances from their homes. Extremely poor individuals also generally lack access to sanitary latrines, most often using open places.

For those extremely poor individuals who can work, dependence on day labour is common across both field sites. This is often associated with migration by respondents in both Rajiapur and Bariakari, due to a lack of jobs for local agricultural day labourers for at least three or four months a year, and in some areas up to six months, due to lags in demand between harvest and planting of major crops, often compounded by the effects of flooding on agricultural fields. During these times, many extremely poor individuals (mainly men) migrate to mitigate the

effects of seasonal food insecurity. Food security may be a problem all year and not just during periods when there is a shortage of work. For some extremely poor households, chronic food insecurity is mainly related to low daily wages, which are often insufficient to feed all household members, particularly those with high dependency ratios. For others, sometimes no or few members are physically able to work due to poor health or disability.

Another feature of extremely poor households is that all family members who are able to work do so for at least some part of the year when work is available, including children and women. Unlike poor households, extremely poor households usually lack the financial resources necessary to cultivate land, even on a short-term sharecropping basis (although in Bariakari, where land is more plentiful, some extremely poor households do engage in sharecropping, albeit for shorter periods of time and on smaller plots of land than poor and middle class households). Involvement in sharecattling occurs among extremely poor households, but to a lesser extent than among better off households, because the former lack the resources necessary to purchase medicine or visit a vet if livestock become ill.

A subset of the extremely poor group—the poorest of the poor—are homeless. These individuals tend to live in other people's houses, or in the kitchen huts of neighbours or family members. They have lost the physical ability to work, either due to injury, poor health, or old age, and they lack family members able or willing to support them. Most often, they are older, non-working widows whose children either live elsewhere, or are also extremely poor and therefore unable to provide assistance. This situation so often defines the poorest of the poor that in one of the wealth-ranking exercises the term '*sami ney*'/'*vikkuk*' (no husband/beggar) was used to distinguish this subset of the extreme poor group, which also tends to include physically and mentally disabled individuals, with those lacking family members to care for them being in the worst position. It is important to note that there is not a perfect overlap between those respondents who self-identify with the beggar group (or who were identified by others as beggars during participatory wealth-rankings) and those who engage in begging as a livelihood activity. Some respondents only use this as a classification to describe their socio-economic condition rather than their source of income.

In terms of dealing with weather-related sources of risk, extremely poor households are both more exposed to the effects of risks like flooding and erosion, because they live more often on riverbanks, and least able to cope with the impacts of these, having fewer resources to fall back on. Often, unloading critical and scarce livelihood resources, such as sharecattle, is the only option for survival; however this erodes the foundations of livelihoods, which often further entrenches such households in extreme poverty. While this was found to be a common coping

strategy in both field sites, it was often only resorted to when all other options had been exhausted, exhibiting among the extremely poor respondent groups in Rajiapur and Bariakari a process similar to that reported in Corbett (1988), whereby preservation of key livelihood resources is prioritized for as long as possible. This is further elaborated in Chapter 7, in relation to the concept of *coping thresholds.*[55]

5.4. Livelihood activities among extremely poor respondents in Rajiapur and Bariakari

This section delves into more detail around the main livelihood activities in which respondents in Bariakari and Rajiapur engage. Table 15 summarizes the share of respondents over the age of seven, according to main livelihood category (the livelihood with which they primarily self-identify), and the share of respondents who have any involvement in each activity (whether as a primary, secondary or tertiary, etc. livelihood activity).

'Agriculture' refers to crops and includes involvement through day labour, sharecropping, and farming owned land or land that has been claimed; 'livestock' refers to rearing animals that are owned, rather than shared (sharecattling); 'land transport' refers to rickshaw, van pulling, and horse and cart work; 'river transport' includes operating a boat for transport of people and goods; 'migration' refers to people who migrate part of the year as a livelihood activity but remain part of the household; 'remittances' refers to people who cite receipt of income from family members who are working elsewhere and no longer live in the household; and 'other' refers to less common livelihood activities that are only engaged in on a secondary or tertiary basis, and includes sewing blankets (*kathas*) for sale at market, making fishing nets to sell at market, collecting grass to sell as fuel wood, and owning a shop.

[55] Data on characteristics of extreme poverty as presented here (elaborated during both participatory wealth-ranking exercises and interviews) correspond to literature and data on extreme poverty in Bangladesh presented in Chapter 4: e.g. high degree of landlessness (Zaman, 2006), and tendency to inhabit poor quality land in marginal areas (BBS, 2007); reliance on insecure employment, especially day labour (BBS 2007); low levels of human capital, particularly education (Zaman, 2006; BBS, 2007; NIPORT, 2009; CARE, 2002; UNDP, 2010); high household dependency ratios (Zaman, 2006); high levels of biophysical vulnerability (Chambers, 1989; O'Brien et al., 2004); and difficulty accessing resources necessary to cope with shocks and stresses—climate related or otherwise (Sen, 2003; Krishna, 2010).

Table 15: Livelihood activities in Rajiapur and Bariakari

	Rajiapur		Bariakari		Total (Both Villages)	
Livelihood category	Primary livelihood	Any involvement*	Primary livelihood	Any involvement*	Primary livelihood	Any involvement*
Agriculture	23%	33%	54%	63%	34%	43%
Livestock		2%	2%	17%	1%	7%
Sharecattling		2%		8%		4%
Fishing	7%	10%	2%	6%	5%	9%
Agricultural trading	1%	1%			1%	1%
Fish trade		1%				1%
Land transport	1%	3%			1%	2%
River transport	2%	3%		4%	1%	4%
Begging	6%	9%		2%	4%	7%
Maid servant	9%	13%		4%	6%	10%
Construction	1%	2%	6%	25%	3%	10%
Migration and remittances	8%	17%	6%	15%	7%	16%
Other		2%		13%		6%
Non-working adult	*17%*		*4%*		*13%*	
Non-working child	*25%*		*25%*		*25%*	
Total Respondents 7+ years	**88**		**48**		**136**	

* Note that 'Any involvement' columns will not sum to 100%

According to interview data, most respondents engage in several of the above livelihood activities at different points in the year, as some work opportunities become available and others more scarce, depending usually on seasonal availability of labour and weather patterns and climatic conditions, albeit this is more true for some activities than others (e.g. strong seasonal dimension to agriculture and fishing, less for activities like maid servant work). While frequent switching among livelihood activities is common, respondents tend to self-identify with one category of income-earning activity (e.g. agriculture, or river-based livelihoods) over others; secondary and tertiary livelihood activities are considered temporary work. For instance, almost every single respondent self-identifying as an agricultural day labourer also engages in fishing, or construction work, or migrates, if and when necessary, usually because local fields are flooded and therefore unworkable. This practice is so widespread among respondent households that frequent and rapid shifts to take advantage of whatever work opportunities become available emerges as a major characteristic of the livelihoods of extremely poor respondents in both field sites.

Md. Majudil Islam (although not a member of the core respondent group), describes this process in Box 1:

Box 1: Frequent switching between livelihood activities

> Md. Majudil Islam (farmer, Rajiapur): "There is a proverb that says 'cut your coat according to your cloths'. So when it is needed, then people do so [switch livelihood activities]. As there is floodwater everywhere the agricultural day labourers have no way to work. Fishermen catch less fish. So to lead their life, they have to migrate and earn money by doing any kind of job. Then when the flood water will go back then they will again return to their profession."

With regard to diversification and wealth, the findings show a difference in the average number of agricultural and non-agricultural livelihood activities per household in the various wealth categories identified by villagers in the participatory wealth-ranking. Table 16 summarizes the data for the two field sites combined; the same patterns were observed in each site individually. Findings indicate a possible correlation between extent of diversification and poverty level: the average number of distinct livelihood activities per family member, age 15 and above, was higher for the upper wealth categories than for the lower ones (although there is a slight decrease between the poor and middle class categories). This was the case for both field sites, and in relation to both agricultural and non-agricultural livelihood activities. It begs the question of whether having more livelihood activities makes people better off in Rajiapur and Bariakari, or if being better off makes it possible to access more livelihood activities. As the research focussed on extremely poor people—and to some extent poor people—not enough is known about the better off wealth groups and the share of family income they actually derive from each activity, to form conclusions.[56]

[56] For a discussion of diversification of rural livelihoods and circumstances under which this may, or may not, be poverty reducing, see World Bank (2007).

Table 16: Average number of livelihood activities per household by wealth category

	Avg. number of livelihood activities			Average number of household members	
Wealth category	Total	Agric.	Non-agric.	Total	15 years old +
Middle class	4.00	2.00	2.00	5.00	2.00
Poor	4.29	1.65	2.65	5.75	3.75
Extreme poor	3.07	1.27	1.80	4.27	2.18
Beggar	1.75	0.33	1.25	1.00	1.00
Total	2.85	1.00	1.85	4.00	2.38

The following sections provide brief descriptions of the main livelihood activities among respondents, i.e. only those activities from Table 15 in which more than 3 per cent of respondents have some involvement. This includes: agriculture, livestock and sharecattling, fishing and river transport, migration, begging, construction, and maidservant work. Findings around the basis for self-identification with certain livelihood activities over others will be analysed at the end of this section, and the frequent switching of livelihood activities will be probed in more depth in Chapter 7, in terms of how this relates to the dynamic nature of coping and adaptation strategies among respondents.

5.4.1. Agriculture

The most commonly reported livelihood activity in both field sites is agriculture, both in terms of primary involvement and any involvement (secondary, tertiary, etc.). This resonates with secondary data sources presented in Chapter 4 on the continued predominance of agricultural livelihoods in Rajshahi-Rangpur generally (BBS, 2008) and in Gaibandha District more specifically (BBS, 2001). This is especially the case in Bariakari, where 54 per cent of the respondent group is dependent on agriculture as a primary income-earning activity, compared to 23 per cent in Rajiapur (Table 15).

Figures 5 and 6 below show a detailed breakdown of the primary livelihood activities of respondents who have some kind of involvement in agriculture (either as a primary, secondary, tertiary, etc., activity). ‘Non-agriculture livelihood’ indicates the proportion of respondents whose primary livelihood is outside agriculture but who have some involvement in agriculture on a secondary or tertiary basis.

Figure 5: Primary livelihoods of agriculture participants (Rajiapur)

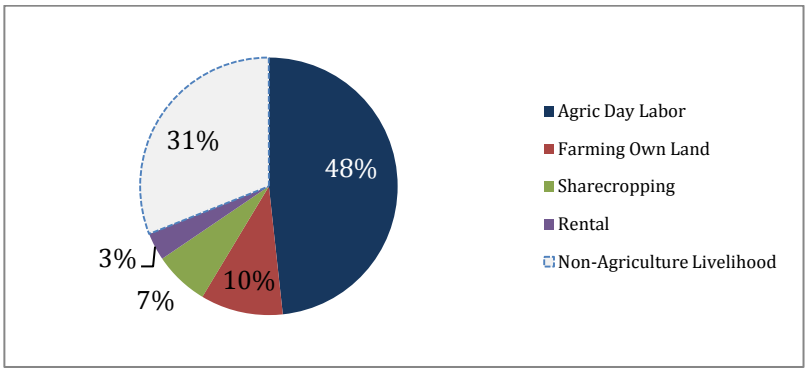
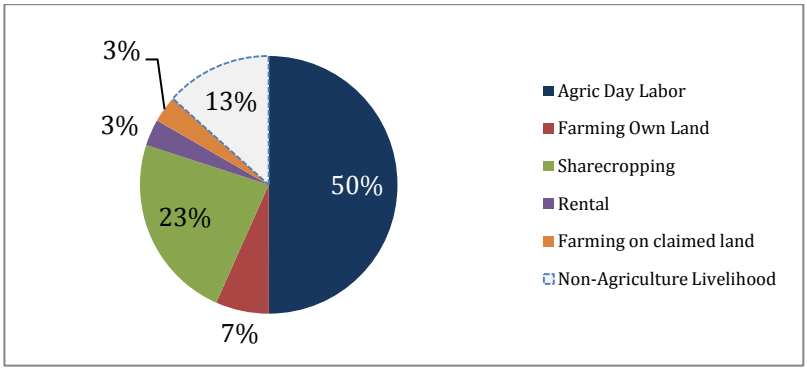


Figure 6: Primary livelihoods of agriculture participants (Bariakari)



In both field sites, the most common agricultural activity among these respondents is agricultural day labour, followed by non-agricultural livelihoods in Rajiapur, and sharecropping in Bariakari; in both field sites some households farm on rented land, on a season-by-season basis.

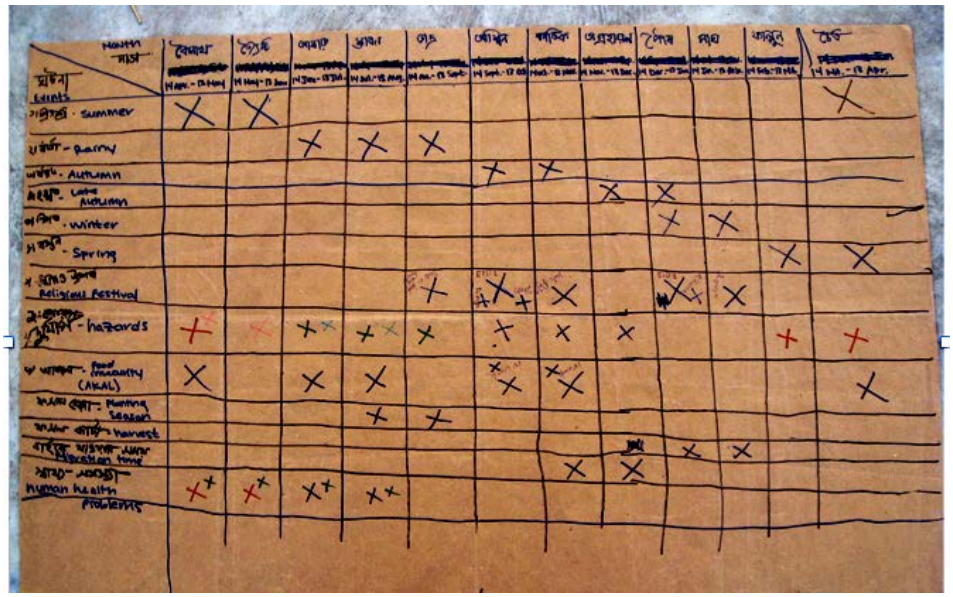
Agricultural day labour is highly seasonal and sensitive to climate-related impacts. Some day labourers work on a contractual basis, but this is rare in the field sites, where respondents normally secure work on a day-by-day basis. Even contracts are usually only for a few weeks' duration, according to the needs of local farmers, which depend on seasonal weather patterns and planting and harvesting schedules for main crops (i.e. *aman*, *boro,* and jute in Rajiapur; maize in Bariakari). The planting and harvest seasons are described below, and shown in Figure 7, the seasonal calendar created by Rajiapur villagers during the CVCA phase of data collection.

- **Maize** (grown only in Bariakari) is planted in the dry season, from mid-November to mid-December (*Ogrohaoen)*; it is irrigated during winter and spring, from December through

April (*Poush* through *Choitro);* and harvested in summer, from mid-May to mid-June (*Joishtho*).

- The ***aman*** **paddy** crop (grown on a large scale only in Rajiapur**)** is sown during summer and the monsoon, between May and July (*Joistho* and *Asharh).* When the seedlings have grown to a certain height, they must be replanted on higher ground. This occurs between August and November, depending on when floodwaters recede, since re-planted *aman* seedlings are damaged if flooded. Depending on the schedule of re-planting seedlings, *aman* paddy is harvested either in mid-December–mid-January (*Poush* month), or in mid-January–mid-February (*Magh*).
- ***Boro*** **paddy**[57] (also grown only in Rajiapur) is planted from mid-December to mid-January (*Poush),* and harvested during summer months before floods begin, some time between mid-April and mid-June (*Boishakh* and *Joistho* months).
- **Jute** (grown in both areas) is planted at the same time of year, sometime between March/April (*Choitro)* and June (*Joistho),* depending on weather patterns, since rainfall is necessary for sowing jute seeds. Jute is usually harvested in *Asharh* (June through July), the first month of the monsoon, although this also depends on weather patterns since the crop must be removed before agricultural fields become excessively inundated by floods.

Figure 7: Seasonal calendar created by Rajiapur village members



(Source: Rajiapur community members)

[57] The planting and harvest times for *boro* paddy are not shown on the seasonal calendar in Figure 7; they were discussed but only planting and harvest seasons for *aman*, the main crop in Rajiapur, are shown on the calendar.

Agricultural labour is generally available during the planting and harvest seasons summarized above, with periods of *monga* occurring between these (Khandker and Mahmud, 2011, 2012; Khandker, 2012). However, some work is still available between planting and harvesting seasons, as paddy and jute fields require maintenance by regular weeding. In addition to *monga* periods, agricultural day labour opportunities decline when adverse weather is severe enough to destroy crops on a large scale. This often happens between June and September/October in both Rajiapur and Bariakari, since both are flood-prone areas. Most local crops are rain fed (except maize, which is irrigated), and are therefore sensitive to drought, which, if severe enough, can destroy crops and reduce employment for day labourers. When agricultural production suffers, those respondents whose livelihoods are primarily dependent on it also suffer from *ovab* (lack of work/income) and *'akal'* (a local word for food insecurity).[58] Most respondents dependent on agricultural day labour cope by either finding alternate income-earning opportunities locally (the most common activity is fishing), borrowing money, or migrating to other districts for work. Coping strategies are elaborated in Chapter 7.

Men and women alike engage in agricultural day labour in both Rajiapur and Bariakari, although women are usually hired for agricultural work that requires less physical strength, such as weeding and tasks that can be performed in or near the homestead, for example husking maize and separating paddy. Men engage relatively more in harvesting, planting, and irrigation activities, as these require greater physical strength and use of agricultural machinery. Men also earn higher daily wages for agricultural work, 100–140 *taka* per day, sometimes including one or two meals. Some male respondents reported earning up to 200 *taka* per day during some seasons, although this is more common for agricultural work in other districts.[59] Generally, women do not migrate for agricultural work, and earn 40–70 *taka* per day locally, depending on tasks performed. Some women also reported making up to 150–170 *taka* per day for husking maize, as payment for this type of work depends on amount husked per day.

Some respondent households farm, usually through sharecropping arrangements, although this is more common among field respondents in Bariakari, which has relatively more agricultural land than Rajiapur. Under sharecropping arrangements, an individual uses a plot of land for a set amount of time, usually during one crop season, paying rent at the end of the lease period in the form of 50 per cent of the total volume produced (BBS, 2001; CARE, 2002, 2005). While widely practised in Bariakari as a whole, sharecropping is generally less common among

[58] Almost none of the respondents in either site refer to periods of lack of work and food insecurity as *monga*.
[59] World Bank, BBS, and WFP (2009) also find that wages for agricultural day labour are higher in other districts relative to Gaibandha.

extremely poor respondents relative to poor respondents and non-poor households outside the respondent group, because of the costs associated with cultivation, for instance renting agricultural equipment for irrigation and purchasing seeds. There is also the risk that yields will fail, usually due to adverse weather, in which case investments are lost. This is particularly hard to cope with when loans are taken from moneylenders or NGOs to cover the costs of cultivation. The risks are too great for many extremely poor households: in Rajiapur, not a single respondent household that identifies themselves as extremely poor engages in sharecropping; in Bariakari only two extremely poor households engage in sharecropping, compared to seven poor respondent households that sharecrop.

Some households also farm on rented, owned, or claimed land. Under rental arrangements, households rent small plots of land for a given crop season; farming on owned land is uncommon among respondents, although a total of four households across both sites do own their own agricultural land (albeit small plots, between around five and 20 *katha*). Farming on claimed land is possible (albeit normally on a temporary basis) in erosion-prone areas, since land accretion also occurs. When land rises, there is a scramble to claim it; often people use newly risen land, which also tends to be nutrient rich and fertile, until rightful owners either arrive to re-claim the land, or more powerful individuals force them off the land.

5.4.2. Fishing and river transport

Fishing is the most common river-based livelihood activity among respondents, although more respondents in Rajiapur engage in fishing as their primary livelihood activity than in Bariakari. Of the respondents who self-identify as fishermen in Rajiapur, most are Hindu. In both field sites, many more respondents are engaged in fishing as a secondary or tertiary activity, which is done occasionally to supplement income and consumption, particularly when little agricultural work is available. Table 15 does not fully capture this, as many in the fieldwork areas are reluctant to admit to fishing.[60] Only men report having any involvement in fishing, as a primary activity or otherwise, although some women do own fishing nets and catch fish from the riverbank (as opposed to out on boats).

Fishing among men can take the form of day labour, when a fisherman works as part of a group on a boat belonging to someone else. In this case, a boat owner hires fishermen to work on his boat, keeps a portion of earnings and pays daily wages to fishermen depending on the total amount of fish caught. Individual fishermen, on the other hand, work on their own boats, or with nets by the river's edge, and keep 100 per cent of their earnings, i.e. any fish they are able

[60] For a discussion of the traditionally low social status of fishermen see Aghazadeh (1994).

to sell after consumption requirements are met. Daily income for fishermen is highly variable, as it depends entirely on the amount of fish caught on any given day, and can therefore range from zero to as much as 500 or even 1,000 *taka* (although it is usually only this high for individual fishermen). Like agricultural day labour, fishing is highly seasonal, with particularly difficult conditions during monsoon months, since currents are strong, and the water level in the river is high, making it both more difficult and more dangerous.

Working as a boatman, driving boats between *chars* and mainland areas, is another livelihood activity found in both field sites, albeit relatively less common among poor and extremely poor households. Three respondents total—two in Bariakari and one in Rajiapur—engage in this kind of work, with two individuals working on a day labour basis, driving boats belonging to others, and one individual working on his own boat, and therefore keeping 100 per cent of his earnings. The latter is the most profitable way to engage in this kind of work, and this respondent earns as much as 600 *taka* per day depending on fees charged to customers and demand for his services, which fluctuates throughout the year. Those working as boatmen on others' boats earn around 200 *taka* per day. Unlike all other aforementioned categories of work, boatman work is available all year, and is most lucrative during the flood season, when transport between *char* islands and even between parts of the mainland become impossible by foot. In both field sites, only men engage in these river-based livelihood activities.

5.4.3. Migration and remittances

Migration has become an increasingly important livelihood activity in both field sites over recent decades, reflecting a wider pattern of increasing importance of migration in the Northwest (CARE, 2002; SIPP, 2004; Zaman, 2006), and greater reliance on remittances as a share of household income (BBS, 2007; ibid, 2006). For respondents engaged in local agricultural day labour and fishing, migration has become an important coping strategy undertaken during periods when local work opportunities are few, whether in between planting and harvesting of main crops, or because of adverse weather conditions at home (Khandker and Mahmud, 2011, 2012; Khandker, 2012; Conroy and Marks, 2008; Zug, 2006). For example, a number of the respondents involved in agricultural day labour migrate in preparation for the flood season, to accumulate savings for the period when local working opportunities become scarce and households have to cover a variety of flood-coping expenses (see Chapter 7).

According to Megh, migration-based coping has contributed to reducing the severity of periods of scarce work and income:

Box 2: Increased incidence of migration

> Megh (agricultural day labourer, Rajiapur): "Now people can migrate to other districts for work, so *ovab* [local word for lack of work] happens less. Though people had small income before too, they would just work here. But people migrate now, because what they can earn here is not enough. The amount of people was less before; now there are more people and everyone has many children, and jobs are fewer because of more people so *ovab* happens. Now people migrate. Before, the people don't know how to go to other districts but now people know because they are more intelligent now. Before, people were also afraid to go in other districts, but now they easily migrate. They think that their income from here is not enough to maintain a family and children."

For some respondents, migration has become a main livelihood activity in itself. These individuals migrate during most months of the year, usually returning for one or two weeks every couple of months, depending on the specifics of their employment. Migrators engage in the following activities: agricultural day labour, as better paid opportunities (200–250 *taka* per day, plus two meals) are found in other districts, with most heading for Chittagong (normally only men);[61] for construction work (men); work in garment factories, mainly in Dhaka (men and women); or migration for begging, which is common among the very poorest respondents (men and women). There is also a group of respondents who do not migrate, but depend on remittances from family members who have moved elsewhere permanently and no longer form part of the local household.

5.4.4. Construction work

For private construction work, day labourers are hired for a range of purposes, such as to raise homesteads, repair walls or roofs, or to help move houses and rebuild them in a new location, often due to erosion. NGOs and the local government often operate cash and/or food for work programmes[62] where daily income is provided for raising roads or other public resources (schools, etc.), as a means of both providing employment—particularly during *monga* periods—and protecting public goods from flood damage.

Men are usually hired for private construction work; for public works, on the other hand, some programmes hire only extremely poor females, and others are open to both males and females (World Bank, 2006). Construction is a more prevalent livelihood activity in Barikari than in

[61] World Bank, BBS, and WFP (2009: 16) find that wage rates for agricultural day labour are highest in the Southeast region of the country, and lowest in the Northwest.

[62] Nationwide, the Food for Work Social Safety Net Programme has expanded rapidly, from 32 per cent of *mouzas* or villages in the 2005 HIES, to 59 per cent in the 2010 HIES (BBS, 2011b). Coverage in Rangpur is lower, and data is not available for Bariakari or Rajiapur.

Rajiapur, although in both sites far more respondents report it as a secondary or tertiary activity, which is likely related to the periodic, programme-based nature of construction work. With regard to NGO and government-run public works programmes, a larger share of respondents in Bariakari report accessing these opportunities than do respondents in Rajiapur. Construction work—both public and private—usually pays 100–120 *taka* per day. In programmes run by the local government, daily wages set at this level function as a self-selection mechanism, since it roughly matches the standard daily income earned by extremely poor individuals.

This is the same logic that operates in NGO programmes. While this makes sense on one level, it doesn't always produce positive results. For instance, in Bariakari, as one element of their programme, the *Chars* Livelihood Programme (CLP) runs earth-digging projects, both to provide local work opportunities, open to the entire community, and to raise beneficiary households above the flood level. However, almost half the beneficiary households entering the programme in 2009 were not raised in time before the floods began and were severely affected by floodwater, including complete destruction of homestead vegetable gardens, which comprised part of the wider asset transfer package provided by CLP. According to these beneficiary households, the 120 *taka* per day wage that was offered by the programme for earth-digging was not sufficient to compete with the going rate for agricultural day labour at that time, as it was harvest season and daily income for agricultural work was slightly more than the CLP was offering. For this reason they were unable to attract enough workers to raise all beneficiary households in time. This underscores the importance of considering seasonality when designing anti-poverty programmes, including fluctuations in labour availability and wages (Devereux and Longhurst, 2010).

5.4.5. Livestock and sharecattling

Ten respondents across both field sites are engaged in sharecattling. Under these arrangements, an individual rears an animal (usually a goat, cow or sheep) that belongs to somebody else, and when the animal gives birth the sharecattler keeps one of the offspring (CARE, 2002). If the animal only has one offspring, it will be sold and the money will be split between the original owner and the sharecattler. It is usually women and children who undertaken activities related to caring for these animals, such as gathering water and food. All of the sharecattling respondents engage in it on a secondary or tertiary basis. Sharecattling is the main way that extremely poor households were able to keep and benefit from livestock, as ownership, especially of cattle, is something that usually only non-extremely poor households can afford (unless as an asset transfer from NGO anti-poverty programmes). However, an additional 10 respondents rear livestock they own, of whom nine acquired their cows as part of an asset transfer under the

CLP; the remaining respondent acquired a goat through sharecattling, i.e. the goat she has taken care of had several kids, of which she was able to keep one.

5.4.6. Maidservant work

Maidservant work is a livelihood activity in which only women and girls engage. It involves household work, mainly cooking and cleaning, in others' homes. Payment is usually in the form of 0.5–1 kg of rice for one day of work, the latter being the equivalent of 40 *taka*. Of the 13 female respondents who engage in maidservant work in some capacity (for eight of whom it is their primary activity), 11 are from Rajiapur. This is because there is easier access to non-poor houses on the mainland than from the *char* (Bariakari). Because this work is extremely low paid, usually only the poorest of the poor engage in it. These are most often older widows who are physically incapable of engaging in more strenuous work. Some young girls from extremely poor families also engage in maidservant work, and this tends to be in exchange for living in the employer's house (often in other districts, like Dhaka), because her own family cannot afford to feed and clothe her. Sometimes young maidservants are also able to attend school this way, with employer families bearing the costs of education, thus providing an additional incentive for extremely poor families.

5.4.7. Begging

Nine respondents across both field sites engage in begging. Of these, all are from the extremely poor and beggar groups. Most of these respondents are incapable of engaging in arduous labour, due either to physical disability or old age. They are mostly older widows who are no longer able to work and whose children either do not live in the local area, or are too poor themselves to be able to provide assistance. Others have become beggars due to health problems or injuries. One family in Rajiapur has become partially dependent on begging because Ashik, the male head of household, is blind and unable to work. He and his wife Fawzia have four children, and all six of them survive on her income as an agricultural day labourer, when this work is available. Ashik supplements this income by begging, although given his condition he must be accompanied by his children when he begs.

All respondents who beg do so outside their home villages. The most commonly reported reason for this is that a majority of local village inhabitants are also poor, and therefore unable to offer much help. Given easier access to markets and other villages, a majority of those who beg are in Rajiapur (eight out of nine); of these individuals, three beg as a secondary activity, supplementing income from other work. Some respondent beggars migrate to other districts to beg, in particular Chittagong and Dhaka, where they report earning much more from begging

than in the local area. There is also a certain degree of seasonality to begging: income for beggars is extremely variable, although it tends to be highest during the month of Ramadan, and also during *Eid ul-Adha*, the latter celebrated to commemorate Ibrahim's willingness to sacrifice his son at the request of Allah (Gulevich, 2005). During *Eid*, it is customary to slaughter animals and divide the meat into three parts, one of which is given to poor people. Most beggars in the respondent group, including Ashik and his family, travel to Dhaka annually for these holidays.

5.4.8. Changing livelihood activities and self-identification

As discussed above and summarized in Tables 15 and 16, almost all respondents across both field sites engage in more than one livelihood activity, depending on the seasonal availability of work. The lack of resources and money that are defining features of extreme poverty also means that extremely poor households have relatively fewer resources invested in their livelihood activities. While not to be considered an advantage, this does translate into greater relative flexibility in terms of switching livelihood activities quickly, if and when necessary. On the other hand, the necessity to engage in various income-earning activities is due to the low paid and seasonal nature of the work extremely poor respondents are able to access.

Regardless of how many activities a respondent may be engaged in throughout the year, there is a tendency to self-identify with a single livelihood activity, most often agriculture. The most commonly cited basis for self-identification with agriculture in both field sites relates to family, with respondents most likely to self-identify with the primary livelihood activities in which their fathers and grandfathers had engaged. Given the dominance of agriculture in the area and the high incidence of land erosion, a great deal of respondents had either owned land themselves and farmed at some point, and/or had family who made a living through cultivation. Even those respondents whose families never owned land, but who engage in agricultural day labour occasionally, tend to self-identify with agriculture. Most respondents speak of the income-earning activities they engage in but do not self-identify with, as something they are "currently doing" but not what "they are." This distinction was most commonly made in relation to fishing among respondents who self-identify as agricultural day labourers, or farmers. Almost every single respondent in both field sites periodically fishes to supplement income/consumption, but only seven respondents in total (six in Rajiapur and one in Bariakari) self-identify with fishing as a primary livelihood activity. This is common in rural Bangladesh:

'There are three types of participant in fishing: subsistence, seasonal and professional. Subsistence fishers are opportunistic and catch mainly for the pot, using small gears. They include labourers, small farmers, women and children, but do not class themselves as 'fishers' (*jele*). Seasonal fishers are a group which has expanded recently in response to crises and

shortage of agricultural land. They are primarily landless and marginal farmers, and fishing has become an important component of their livelihoods. Professional fishers were traditionally Hindus' (Ali et al, 2003: 9).

Religion seems to constitute a major basis for self-identification as a fisherman among respondents: out of the seven aforementioned respondents self-identifying as fishermen, five are Hindu. The reluctance of non-Hindu respondents to self-identify seems to be in part related to the low social status accorded to fishing as a profession (Aghazadeh, 1994). However, while there is a trend occurring across rural Bangladesh whereby Muslim agriculturalists are increasingly entering fishing as a full time profession (Townsley, 1998), and this was also found to be the case among the respondent group (i.e. the two Muslim respondents who claim fishing as their main livelihood), there remains a strong sense that agriculture-based livelihoods are superior to river-based work. The basis for this hierarchy among respondents seems to be a combination of negative associations attached to fishing related to caste/class, family tradition, and also reliability of daily income and ability to save money:

Box 3: Hierarchy of agriculture and fishing based livelihoods

Dewan (sharecropper, Bariakari): "The fishermen are engendered [do it generation after generation]; they are a different class people. If agricultural day labourers start fishing, it will be insulting for them, beneath them. Farmer or agricultural day labourers are upper class than fishermen and boatmen. And according to prestige, farmers and agricultural day labourers are of same position, though agricultural day labourers are a little beneath than the farmers. But fishermen and boatmen are beneath than agricultural day labourers. Because it is their profession to catch fish and to sell it in the market, fishermen have to live day by day from what they catch. But we are farmers; we can store food and money… Our profession depends on what our grandparents and parents did. Our parents taught us this. It did not go and it will not go from us. And their parents also taught them fishing. It is their work and it is their class. And we are farmer. Both of us will never leave our profession… Fishermen and boatmen are considered lower than farmer because farmer can make money and save money by their work, and by this money they can do many things. But fishermen lives hand to mouth. They do not make income enough to save. Though agricultural day labourers are beneath than farmers, but fishermen and boatmen are beneath than agricultural day labourers, they can store some money but fishermen cannot."

This illustrates the complexities involved in transitioning into new professions on a permanent basis, and has implications for how far flexibility in shifting livelihood activities temporarily throughout the year may actually translate into increased adaptive capacity over the longer term. 'Attachment to occupation,' (Marshall et al., 2010) and socio-cultural barriers (Adger et al., 2009; Nielsen and Reenberg, 2010) in the form of negative associations with certain income-earning activities, may in some cases hinder the development of adaptive capacity, to the extent that transitioning into livelihoods that are locally considered taboo may provide greater resilience to climate variability and change.

5.5. Conclusions

This chapter draws on primary data from all three phases of fieldwork to illustrate the village context and location of each field site, as well as socio-economic groups, and livelihoods among extremely poor respondents in Rajiapur and Bariakari. The data presented in this chapter go part of the way towards answering the research question *what is the nature of climate change vulnerability among extremely poor households and individuals in the fieldwork areas?* Setting the local context in which extremely poor respondents pursue their livelihoods necessarily precedes an exploration of how shocks and stresses—climate and non climate-related—affect livelihoods, and the coping strategies undertaken by respondents.

Findings from participatory wealth-ranking activities highlight differences between rich, middle class, poor, and extremely poor households in terms of: amount of financial and productive resources (e.g. land, livestock); extent of livelihood diversification; access to basic amenities (clean water and sanitation); food security; ability to educate their children, and meet household health needs; and nature of relationships and networks. Extremely poor respondent households are also distinguished from non-poor households by their relative vulnerability to climate-related shocks and stresses in several ways, including: The extent to which homes are exposed to extreme events (e.g. flooding and erosion) by virtue of their proximity to the river; the sensitivity of their homes to wind, rain, storms, and other weather patterns as a result of the durability of the materials used in their construction; their access to secure and/or non-natural resource dependent jobs; their ability to access government safety net programmes, especially those designed to help in coping with climate-related shocks and stresses (e.g. flood relief).

These findings provide empirical support for the relationship between poverty and vulnerability to impacts associated with climate variability and change. In particular, findings illustrate the nature of exposure and sensitivity of resources and livelihoods among extremely poor respondents, and patterns of differentiation that emerge even across households and individuals within the extremely poor respondent group.

CVCA and household interview data reveal a great deal of livelihood differentiation at the intra- and inter-household levels, illustrating differences both between the two field sites as well as among different social groups (e.g. men, women). Agriculture is the most prevalent livelihood activity category in both field sites, however a greater share of households have some involvement in agriculture in Bariakari than do those in Rajiapur, and a far greater share (almost double) depend on agriculture as a primary livelihood in Bariakari (Table 15, Section 5.4). This illustrates the relatively more predominant role of agriculture and lack of access to non-agricultural work in *char* areas relative to mainland areas. In terms of regional differences, respondents report earning a much higher income for agricultural work in other districts than in Gaibandha, encouraging many male respondents to migrate for at least part of the year. At the intra-household level, only men migrate for agricultural day labour, with women staying home to care for children. The only female respondents who migrate are widows, and this is mainly to beg in larger cities. In terms of income, male agricultural day labourers earn about double that of females, but they also engage in more strenuous types of agricultural day labour, including planting and harvesting of main crops, with women engaging primarily in activities such as paddy husking and weeding of agricultural fields.

Many of the activities carried out by women are those that can be done near or at home, highlighting their central role in caring for their families and homes. In addition to paddy husking, women, as well as children, are responsible for rearing livestock, and also engage in maidservant work. Similarly, they do not fish on boats in the river, but use nets to engage in fishing only at the river's edge. Furthermore, seemingly regardless of depth of household poverty, women are expected not to work during certain phases of life: for the year or so after marrying, and after the birth of children.

Diversification of income sources emerges as a widespread characteristic across respondents, although slightly more so among the non-poorest of the poor. However, findings around self-identification with certain livelihood activities highlights the role of the local socio-cultural context in influencing local perceptions of what diversification might entail. This, in turn, has implications for strategies for adaptation that are aimed at encouraging diversification and transitions into new, more climate-resilient livelihood activities entirely, or exploring what diversification might look like as an adaptation strategy (Sabates-Wheeler et al., 2008).

Following chapters build on the picture of livelihoods presented here by drawing further on primary data to analyse the factors and processes that mediate patterns of differentiation, as well as the commonalities that exist across respondents with respect to vulnerability to multiple shocks and stresses, of which climate and weather are one of many (Chapter 6), and in patterns of coping with the effects of climate-related shocks and stresses (Chapter 7).

Chapter 6:
Vulnerability to climate and non climate-related hazards in Rajiapur and Bariakari, and perceptions of change

6.1. Introduction

This chapter explores perceptions around the climate and non climate-related hazards that respondents identify as major sources of risk to their livelihoods. The purpose is to analyse climate-related shocks and stresses within the wider context of multiple stressors that characterize the lives of extremely poor respondents. Section 6.2 provides an overview of the main climate-related hazards that have always characterized life in Rajiapur and Bariakari: flooding, riverbank erosion, storms, and drought. Section 6.3 does the same for the major non climate-related sources of risk and vulnerability, including: health-related shocks, dowry, food insecurity, and poverty insecurity (i.e. additional dimensions of insecurity related to extreme poverty). Section 6.4 explores the interaction of climate and non climate-related sources of risk and vulnerability, highlighting differentiation between the two field sites in terms of perceptions of risk attached to different hazards and the factors that underpin these perceptions. Section 6.5 concludes with an analysis of respondents' perceptions of the ways in which climate has changed over recent years, including extreme events (erosion, flooding, storms) and shifting weather patterns (drought, rainfall, temperature), and how these changes have affected livelihoods. This section also explores respondent perceptions of changes in their household situation (*obosta*—life condition) over the last 10 years. These sections draw on all phases of data collection: CVCA (in particular historical timeline and vulnerability matrix), household interviews, and in-depth life histories with a subset of respondents in the two field sites.

Findings indicate that, looking retrospectively, most respondents (78 per cent) feel poverty has worsened in the past 10 years (85 per cent in the Rajiapur embankment site, and 67 per cent in the Bariakari *char* site). Erosion was a major cause in both field sites, but a set of other climate and non climate-related factors were also important. In both field sites, strong connections exist between the climate and non climate-related risks, and this is drawn out in the analysis of where climate fits into the wider context of multiple stressors, compounding the overall vulnerability of respondents.

While the two field sites produced a nearly even 51:49 per cent split between the two broad categories of risk (climate and non-climate related), the distribution of individual threats within each category was very different, i.e. different concerns are important to the people in these two locations. In terms of perceptions about the relative importance of the various climate risks, now and for the future, erosion was consistently emphasized in Rajiapur, while in Bariakari, flooding and storms were identified as the greatest climate-related challenges. There were also differences in how respondents in the two field sites rank the relative severity of non-climate risks. This illustrates a central finding of this research: that even between two sites that are located in neighbouring unions, in the same district, subject to very similar weather patterns and, broadly, to similar policy, governance, and socio-economic environments, communities have significantly differentiated perceptions of sources of vulnerability. This provides empirical support for the oft-made claim that vulnerability is highly context specific.

6.2. Main climate-related sources of risk and vulnerability

The main climate-related sources of risk and vulnerability reported by field respondents in Rajiapur and Bariakari include: flooding, riverbank erosion, drought, and storms. These hazards have always been present in the field site areas and this section introduces the historical climate—livelihoods context. Most effects have been felt both in the following direct and indirect ways: (1) destruction of resources (both through physical impact of the climate-related event on resources, and in the unloading of resources as a coping strategy in the aftermath of climate-related impacts); and (2) effects on income-earning activities.

6.2.1. Flooding

Both communities experience impacts annually, regardless of whether it is a mild or severe flood year. Regular annual flooding usually occurs during summer (*Grisma)* and monsoon (*Borsha)* seasons, between the months of June and August, and can have both positive and negative effects (Hofer and Meserli, 2006; Yu et al., 2010; Schmuck-Widmann, 1996). There exist two words in Bangla to describe floods: *borsha* has positive connotations, and refers to the replenishing effects of normal floodwaters have when they bring nutrient-rich sediments that restore productivity of agricultural land; *bonna*, on the other hand, is used to describe severe flooding, and is associated with negative effects (Haque and Zaman, 1994: 74), such as damage to and destruction of resources, and loss of income-earning activities like agricultural day labour due to submerged local fields. According to respondents in both communities, the negative effects of flooding—even during regular, annual floods—outweigh the positive, especially for extremely poor households.

Responses about perceptions of flooding are shown in Table 17. In terms of how flooding compares with other sources of risk and vulnerability, nine per cent of responses[63] in Rajiapur and 15 per cent of responses in Bariakari report floods to be the worst overall hazard they face. Comparing across weather-related hazards, 28 per cent of responses in Rajiapur and 24 per cent of responses in Bariakari report floods to be worse than any other climate-related hazard.

Table 17: Share of responses rating flooding as the most serious hazard (%)

Field site	Among all hazards	Among all climate-related hazards
Rajiapur	9	28
Bariakari	15	24
Both field sites	11	27

Findings on the livelihood effects from flooding on respondents in Rajiapur and Bariakari echo many of those discussed in the literature on flooding in Bangladesh (see Chapter 4, Section 4.6.1.2). In terms of resources, damage to infrastructure from flooding is common across Bangladesh (MoEF, 2009; Ninno et al., 2001), and this was also found to be the case in both field sites. Houses of extremely poor respondents are constructed mainly out of un-durable materials, such as jutestick and bamboo, and therefore quickly rot during the flood season and have to be replaced, usually on a yearly basis. During severe floods, houses are often washed away entirely, leaving respondents homeless, or more often living in the homes of neighbours and family members, until they can afford materials to build a new home. Loans from NGOs and moneylenders are often taken to rebuild homes. Vegetables grown on homestead land—which are both consumed and sold for income—are submerged and often destroyed. Damage to infrastructure of importance to the wider community is also common, for instance to mosques, temples, and schools, meaning that children are unable to attend school (this applies mainly to children in Rajiapur, as well as to the smaller subset of children in Bariakari who attend schools on nearby *chars*). Tube wells that are not raised become flooded, making the water undrinkable and increasing pressure on the few local tube wells that are raised. This is not usually problematic unless flooding is prolonged, in which case usable tube wells become strained, sometimes causing conflicts with owners of raised tube wells.

[63] Not all respondents were able to answer the question of which hazard is the most challenging to their livelihood, therefore the responses indicated in this chapter are out of total responses to this question, of which there were 74, rather than total number of respondents.

When there is no, or limited, access to tube wells, respondent households often drink floodwater, which they only sometimes boil, leading, in turn, to health problems like diarrhoea and vomiting. Latrines also become inundated, creating unsanitary conditions, particularly when waterlogging occurs for prolonged periods after flooding. This causes additional health problems, most notably skin infections from spending time in dirty water. A majority of respondents report that this disproportionately affects women, who spend the most time in floodwater while carrying out household work. Ali and colleagues (2006) note that women in Bangladesh are especially vulnerable to the health effects of flooding. Data from both field sites suggest that children are also particularly at risk from flooding, as they often do not realise the negative effects of playing in floodwater.

Livestock are negatively affected, unless moved to raised land. Some animals, particularly goats, sheep, and chickens are easily washed away and drown, and this is also the case for cattle when the water level is high. Supplying food for livestock becomes a challenge for extremely poor households, since grass in the surrounding area is submerged, necessitating the purchase of livestock feed. This is a problem for weeks after floodwaters recede, since grass contaminated by remains of floodwater continues to make animals sick. Animals—particularly cattle—also suffer from skin diseases caused by exposure to floodwater.

Community members in Bariakari face even greater challenges due to the distance they must travel to the mainland to access veterinary services. It takes time and money to get a veterinarian to visit the *char*, and it is common for animals to die in the meantime. For these reasons, when respondent households are unable to find raised areas for livestock during flooding, they often have no choice but to return sharecattle to their owners, or sell animals they own. While, on the one hand, unloading animals during flooding is a common coping strategy among respondents (this will be elaborated in Chapter 7), this decision is just as much a result of the inability of respondents to care for livestock during flooding, as it is a means of acquiring much needed cash to purchase food and other necessities. The *Chars* Livelihood Programme (CLP) makes veterinary services and medicine for livestock available throughout the year, since it transfers livestock to beneficiaries.

In relation to effects from flooding on work, impacts across respondents are differentiated across livelihood groups. For fishermen, high water levels in the river during the flood season make it more difficult to catch fish, and this is compounded by dangerous conditions from heavy rainfall and wind, which are common during this time of year. Agricultural fields belonging to local farmers in both fieldwork areas become submerged, and as a result day labourers are not hired. When flooding is severe enough to damage crop yields on a wide scale,

prices for staple foods like paddy increase in the local area. The combined effect of increased food prices, lack of work opportunities, and little or no savings to fall back on, is particularly acute for extremely poor households.

Box 4: Effect of flooding on work availability and food prices

> Laboni (agricultural day labourer, Rajiapur): "Now farmers are cultivating land and they plant paddy, and if now the rainfall and flood happens then it will destroy the paddy. If it will destroy the paddy then we are the most affected people because the farmers can't hire us as agricultural day labourer, and if the rice destroys, the price of rice will be rise. So it will be difficult for us."

Box 5: Effect of local weather on crop prices

> Ashik (beggar, Rajiapur): "When [local] crops are destroyed, then crops come to our market by vehicle from long distances, so the shopkeepers take higher price from us. If the crop yields here, I can buy at 5 *taka*, but when the crop comes from another place, I have to buy it at 10 *taka*."

6.2.2. Riverbank erosion

Erosion comprises a major source of risk to livelihoods in both Rajiapur and Bariakari. According to respondents, strong currents pushing against riverbanks induce erosion, which historically occurs more rapidly in areas with poor soil quality and during periods of heavy rainfall and flooding. In both field areas, erosion is correlated with poverty to such an extent that local NGOs and field respondents alike list it as a major criterion of being extremely poor. Between the two field sites, however, a larger share of responses about the greatest overall hazards were about erosion in Rajiapur:

Table 18: Share of responses rating erosion as the most serious hazard(%)

Field site	Among all hazards	Among all climate-related hazards
Rajiapur	34	57
Bariakari	11	46
Both field sites	26	52

This seems to contradict literature that highlights the disproportionately high vulnerability of *char* areas to erosion (e.g. Ali et al., 2006; Kabir, 2006; MoEF, 2012); however a few factors may underlie this differentiation. First, the physical location of the respondent group in Rajiapur, on an overcrowded mainland embankment area, makes the challenge of finding new land when affected by erosion relatively greater than for respondents in Bariakari, where the population density is significantly lower. Also, findings suggest that, on average, respondents in Bariakari have been affected by erosion far more times in their lives than have respondents in Rajiapur. The ubiquity of erosion in the lives of Bariakari respondents suggests that they may be more likely to view it as a normal part of life than their Rajiapur counterparts, for whom the perception of disaster may be greater. The ever-presence of erosion is illustrated in the comments of two Bariakari respondents:

Box 6: Moving *chars*

Tamanna (agricultural day labourer): "We always move from this *char* to that *char* for erosion. We cannot stay in one place for a long time. Maybe we start to settle somewhere, we plant vegetables and maybe some trees, make our house. Then erosion comes and we move again."

Box 7: We are "river-eroded people"

Zubayer (farmer, Bariakari): "I am river-eroded people. He who has riverbank erosion in his life, it is difficult for him to spend his whole life. Because of riverbank erosion, I am moving from one *char* to another *char*. This is my whole life."

As both these interview excerpts indicate, however, the frequent occurrence of erosion in Bariakari, and in *char* areas generally, does not preclude it from comprising a serious risk to livelihoods, and in fact, of responses ranking weather-related hazards, respondents in both field sites report that erosion is by far the greatest and most destructive one they face (57 per cent in Rajiapur and 46 per cent in Bariakari, shown above, in Table 18).

Unlike other climate-related events that usually cause more reparable damage, riverbank erosion, especially when it occurs unexpectedly, completely destroys everything in its path. This usually includes critical livelihood resources, such as agricultural and homestead land, homes, tube wells, sanitary latrines, and other resources like trees and vegetable gardens. This both knocks non-poor households into poverty and erodes the limited resources of extremely poor

households, entrenching them further. It is the poorest households that suffer most from erosion, since they inhabit the worst quality land, usually next to the river and most at risk. Some respondents (mainly in Bariakari) have been affected as many as 15 times, and describe this as being stuck in a constant cycle of destruction and rebuilding that does not allow accumulation of resources past a very low level. Those respondents involved in cultivation in some capacity (also mainly in Bariakari) lose both the value of the land when it erodes (in the few cases of ownership) and/or investments made in cultivation (e.g. for seeds, irrigation, fertiliser). A recent study of the livelihood effects from erosion in Gaibandha highlights this process as a major cause of impoverishment in the area:

> "The major agricultural production of a calendar year in Gaibandha is Boro-Pulse-Jute. In addition to this, they produce homestead vegetation to fulfil their daily demand. It was revealed from the study that loss of one hectare of agricultural land produces a total profit loss of 17,795 [*taka*]. People of these areas are generally poor and such loss makes them ultra-poor" (Uddin and Basak, 2012: 3).

It is common for households involved in production to take loans to cover costs of cultivation; however when land erodes and crops are lost, these respondents are often left with no means but to take additional loans to repay initial ones. In Rajiapur, few extremely poor respondents either own or cultivate land, and therefore a greater share of respondents experience the effects of it through diminishing opportunities for agricultural day labour. In terms of effects on other livelihood activities, fishermen also list erosion as a threat to their livelihoods; due to silt deposition from erosion, the water level in some rivers decreases, diminishing space for fishing, as well as the number of fish in the river, and, in turn, incomes.

Erosion can also engender social conflict, with, for instance households moving to new locations and claiming land that belongs to other people, out of necessity, frequently ending up in violent conflicts. Another way erosion may cause social conflict, especially in Rajiapur where overcrowding is a more serious issue, is when sharecattle animals belonging to someone whose land has eroded then wander onto neighbouring homestead land or nearby agricultural land for grazing, destroying other people's crops and vegetables and leading to conflict between households, and fees for collecting animals that have been 'impounded' for this reason:

Box 8: Erosion and livestock rearing

> Reshmi (sharecropper, Rajiapur): "When riverbank erosion happens, where will I keep my goat? Now erosion already started and I will move my house, then it will be difficult to rear the goat, it will go on other's agricultural land to eat grass, so other people will punish the goat. They will bind the goat and put it in the pound. If one person's goat eat crops from other's agricultural land then the landowner takes the goat and gives it to the pound [*khoar*; local term—*khoira*]. The people of *khoar* bind the goat in one place. Then the goat owner go to the *khoar* and take the goat back by giving money. You have to give 50 *taka*. If I had my own land, I would easily rear the goat, it would eat grass on my own agricultural land."

Another erosion-related source of conflict emerges over land ownership. The government often distributes plots of land on newly risen or re-emerged *chars* as *khas* land to extremely poor families. Often, original owners of the land re-appear (sometimes with their land titles, other times simply claiming they are the rightful owners), or more powerful local farmers oust new landowners, which often erupts into violent conflict (FAO, 2004). Lack of any coherent government policy to address issues of land erosion and reclamation, or to provide support to victims of erosion, other than river training works and construction of embankments (which have been largely ineffective) makes the recovery process all the more difficult (Ali et al., 2006; Hutton and Haque, 2004).

Reflecting findings in the literature on livelihood effects from erosion, children suffer perhaps the longest-lasting impacts, as schooling is often disrupted due to frequent re-locations (Ali et al., 2006; Uddin and Basak, 2012). This was certainly the case for children in Bariakari, who moved from a *char* where they were in school to one where no schools exist; it took several months (after the end of fieldwork) for children to re-enter school, and as of July 2012, only three respondent children who had previously been attending school before moving to Bariakari due to erosion had re-enrolled. This same effect exists for adult respondents who are part of NGO programmes in their home communities, when they are forced to move elsewhere due to unexpected erosion, and can no longer participate in these programmes. The cost for travel by boat to participate in NGO activities, or for children to attend school on nearby *chars* is 5 *taka* in each direction (for field respondents in Bariakari), which is more than most respondent households can afford to spend on a regular basis.

6.2.4. Drought

Drought occurs during the spring (*Basonto*) and summer (*Grisma*) months, usually from February into the beginning of May, although is most severe during March and April. Relatively more respondents think of drought and lack of rainfall as a problem than too much rainfall. Of

these, a larger share who perceive drought as a problem reside in Bariakari: one respondent there reported drought as the worst overall risk to livelihoods. Among responses about the relative severity of climate hazards, four per cent list drought as the top climate-related hazard in Rajiapur as opposed to nine per cent in Bariakari.

The perception that drought comprises an important risk to livelihoods may be greater in Bariakari because of the greater involvement in agricultural production in that field site relative to Rajiapur. Most of the sharecropping respondents in Bariakari depend on rain for cultivating their crops, since they either cannot afford to rent shallow water machines for irrigation, or are unable to access them during cultivation seasons, since there are few on the island. According to those engaged in crop production in Bariakari, the quality of the land, particularly in South *Para*, is relatively poor, so even when shallow water machines are used to irrigate land, if this is not done frequently, drought and extreme heat often still destroy crops since the soil does not retain moisture well. When crop yields fail, it can be very difficult for extremely poor households to recover from the combined effect of losing money invested in sharecropping, forgone income from selling crops, and having to purchase food they had anticipated supplying for themselves. Accordingly, the perception of drought as a major livelihood risk is greater among Bariakari respondents than among Rajiapur respondents, since those respondents are at greater risk of loss from production failure due to drought. Homestead vegetables, in both field sites, which provide an important source of food as well as extra income after consumption requirements are met, are also badly affected by drought, and often die during the dry season.

Drought also affects agricultural day labourers when severe enough to affect agricultural production on a larger scale, leading to widespread lack of work together with increased food prices. Even when work is available, conditions during dry, hot months become very difficult for agricultural day labourers to physically endure, especially for older individuals, as well as those who suffer from high blood pressure. Hot, drought-prone months are even more difficult to manage in Bariakari than in Rajiapur, since there are almost no trees or sources of shade on the entire island to offer respite from extreme heat and sunrays. Exposure can cause illness; especially fever, among community members, especially, again, among older members of the community and those who are already in poor health, but also for children. Livestock also suffer during drought, and sometimes perish due to lack of fodder, as the grass they consume also dies from drought and extreme heat. Providing food and water for livestock during extreme drought is particularly challenging for extremely poor households, who must either purchase fodder or travel far distance to collect grass.

In both field sites, groundwater levels decrease dramatically during March and April, affecting tube wells such that either the water becomes extremely hot, and thus difficult to drink, or dries up entirely. Almost every single respondent, across both field sites mentioned experiencing this problem, identifying the origin of it with the widespread adoption of groundwater irrigation in the local area. This suggests that local communities perceive and are affected by a reduction of groundwater levels that probably result from government policies to increase rice production and expand the area under *boro* cultivation in the Northwest (Yu et al., 2010) (see Chapter 4, Section 4.3.1). The drying up of groundwater during these months is reportedly less severe for deep tube wells (more than 60 feet); however a majority of the tube wells in both field sites are shallow, deeper tubes being more expensive.

6.2.5. Storms

Storms occur regularly (as often as every two or three days) during summer, beginning from *Boisakh* month (mid-April through mid-May), and are among the most dangerous weather-related events for extremely poor households, due to high physical exposure, living often right next to the river, and in poor-quality housing. Four per cent of responses from Rajiapur and 15 per cent from Bariakari indicate that storms are the greatest overall hazards respondents face:

Table 19: Share of responses rating storms as the most serious hazard (%)

Field site	Among all hazards	Among all climate-related hazards
Rajiapur	4	11
Bariakari	15	21
Both field sites	8	15

This differentiation is reportedly based on the difference in presence of durable, solid structures between the two locations. In Bariakari, all houses, even those of relatively wealthier community members, are constructed out of jutestick and tin; in Rajiapur, on the other hand, the houses of some rich and middle class community members (outside the core respondent group), and some nearby schools and one Hindu temple, are constructed of concrete, meaning that respondents have a safe place to seek refuge during storms (this is further elaborated in Chapter 7, on coping).

Homes of respondents are often torn apart, with walls and roofs flying right off bamboo pillars. Tin roofs are often lost during storms, which extremely poor respondents had spent months saving money in order to purchase, and are therefore not easily replaced. These effects tend to

be the same across the two field sites, since similar housing materials are used by extremely poor households in Bariakari and Rajiapur. In addition to damaged homes, respondents themselves are sometimes injured while taking shelter inside their homes during severe storms, due to collapsing roofs and walls. Falling trees also injure community members and livestock, as well as damage homes and buildings. Homestead vegetable gardens are also destroyed during storms. Crops in fields can be damaged in severe storms, after which agricultural day labour is less available. Regardless of availability of work, conditions during severe storms are frequently too dangerous for field respondents to engage in any kind of work.

Boatmen and fishermen are especially vulnerable to dangerous work conditions since storms begin suddenly while they are on the river. Family members of some field respondents have drowned due to strong currents on the river during storms, and other respondents have lost boats or boat engines, which are costly to replace. Livestock can also perish or become seriously injured if not moved inside homes before storms. Children cannot attend school during severe storm conditions, and although this is usually only for one day at a time, storms happen frequently between April and June, which can add up to many days of missed school. This is more of a problem for children in Rajiapur, since school attendance rates among children there are greater than in Bariakari.

6.3. Non climate-related sources of risk and vulnerability

The most commonly cited non climate-related sources of risk and vulnerability to respondent livelihoods include: (1) health-related risks including injuries; (2) dowry payment requirements; (3) food insecurity, and; (4) poverty and insecurity. The final category is an aggregation of perceptions about other dimensions of insecurity that are related to poverty, for instance insecure access to work and income, and resources, of which the most commonly stated was lack of family support networks.

While most of these sources of risk and vulnerability are not as directly related to climate as the hazards presented in Section 6.2 above, they all have a strong climate-related dimension, which will be drawn out in the sections below.

6.3.1. Health shocks

Physical ability to work is the most important resource for extremely poor respondents; sickness and injury therefore comprise a major risk to livelihoods. Of all responses about overall shocks,

18 per cent report health shocks as the worst overall problem, this is comprised of 11 per cent of responses in Bariakari and 21 per cent in Rajiapur. Among non climate-related hazards, 35 per cent of responses from Rajiapur indicate health shocks as the most serious, and 24 per cent among Bariakarians' responses:

Table 20: Share of responses rating family health shocks as the most serious hazard (%)

Field site	Among all hazards	Among all non climate-related hazards
Rajiapur	21	35
Bariakari	11	24
Both field sites	18	31

Health shocks are perceived as a less important risk factor to livelihoods among Bariakari-based respondents, perhaps due to the fact that, despite its being a *char* area separated by the river from mainland health clinics and hospitals, there is an NGO-sponsored health programme in Bariakari only. While in Rajiapur there is a nearby GUK-sponsored community centre providing health-related information, a health clinic is part of the CLP programme in Bariakari, and another NGO programme sends a doctor to the community once a month (Chapter 5, Section 5.2.1 and 5.2.2).

Health shocks are damaging to livelihoods in two main ways—first from the high cost associated with medical treatment, particularly for serious and/or prolonged conditions. Secondly, in cases where a male head of household is injured or falls ill, income from the highest possible income earner is lost (Pryer, 1989). In cases when effects of ill health or injury are temporary, households can usually recover, but long-term or permanent effects can engender a downward spiral that households have a very hard time coming out of (Krishna, 2010; Sen, 2003).

While most respondents talk about health shocks as being unrelated to climate, they have strong climate-related dimension (Biswas, 2005; CARE, 2005; Ali et al., 2006; Krishna, 2010). Further probing during vulnerability matrix CVCA exercises and during interviews revealed this to be the case among respondents in both field sites, where many health shocks were the result of adverse weather and climate extremes. As described in Chapter 4, Section 4.6.1 in natural hazards in Bangladesh, flooding, cyclones, and drought are all associated with health consequences, especially for extremely poor people who tend to start out from a baseline of

poor physical health, often due to malnutrition and greater exposure to risky jobs and environmental conditions (Krishna, 2010).

6.3.2. Dowry

Dowry payment requirements have become staggeringly high in both field site areas over recent decades. Respondent households with daughters report dowry demands of anywhere between 15,000 and 50,000 *taka*, which is extraordinary considering extremely poor respondents earn between 100 and 150 *taka* per day (depending on what kind of work they engage in; income for females also tends to be lower). Most daily income among respondents is spent meeting daily food consumption requirements. As shown in Table 21 below, 15 per cent of responses about most serious hazards in Rajiapur reported dowry as the worst, as opposed to only four per cent in Bariakari. Among responses about relative severity of non climate-related hazards, 23 per cent in Rajiapur report dowry to be the worst, and eight per cent in Bariakari.

Table 21: Share of responses rating dowry as the most serious hazard (%)

Field site	Among all hazards	Among all non climate-related hazards
Rajiapur	15	23
Bariakari	4	8
Both field sites	11	18

The difference between the two sites here is because a larger share of respondent households in Rajiapur have marrying-age daughters than do those in Bariakari. For the households with daughters approaching marrying age, dowry requirements are considered an incredible challenge to comply with. The option of not marrying one's daughter, on the other hand, is unfathomable to most respondents, since this would bring great shame to the family, and put the daughter in question in danger, since an unmarried female after a certain age becomes a target for sexual harassment. Some young female respondents no longer feel safe alone, in or outside the home due to potential harassment from males. Rifat Ara, an 18-year-old unmarried respondent in Rajiapur describes this:

Box 9: Poor girls are preyed on if families cannot arrange marriage

> Rifat Ara (maidservant, Rajiapur) "There are some very poor people who have no ability to arrange marriage for their daughter. So, other people try to harass these girls when her parents are not at house. It can be day or night, if a girl is alone in the house, her parents will not be there, then they come to rape them. Nothing like that happen to me but it happened with other girls in the village. It happens. The boys see that the poor people don't arrange marriage for their daughters, the girls are enough matured but they are unmarried. So some bad boys try to harass these girls… The bad boys don't do it with rich man's daughter. Because the rich men arrange marriage for their daughter very early, it's easy for them. But the poor men can't arrange marriage for their daughter. They have to wait and the girls are enough matured to get marry."

Extremely poor respondents still hope to marry off daughters, and do anything in their power to make this happen. This includes working as much as possible, and migrating as often as possible, since incomes for agricultural day labour in other districts are higher than in the local area (World Bank et al., 2009). This also includes selling off valuable, productive resources, such as livestock, the tin off their houses, crops from sharecropping—anything respondents are able to acquire. Borrowing large sums of money—usually at high interest rates from local moneylenders, since NGOs attempt to discourage dowry payment practices and so do not provide loans for this purpose—is another common strategy for complying with dowry demands. It is common for young women from respondent households to marry before her family finishes paying the total sum agreed upon for dowry. Until the groom's family is paid in full, a new bride often suffers verbal and/or physical abuse, and torture even, at the hands of her new husband and his family.

Unlike other non climate-related sources of risk and vulnerability, dowry does not have a clear climate-related dimension per se. However, when discussing the interaction of different shocks and stresses, many respondents identified dowry-climatic shock overlaps (in particular dowry and flooding or erosion) as comprising a particularly challenging combination, given that coping with each requires liquid resources usually well beyond what is feasible for respondent households.

6.3.3. Food insecurity

Of responses about overall worst hazards, six per cent of Rajiapur-based responses report food insecurity to be the worst, and 15 per cent of responses in Bariakari. Fifteen per cent of responses in Rajiapur and 23 per cent of responses in Bariakari indicate that food insecurity is the worst of the non climate-related hazards.

Table 22: Share of responses rating food insecurity as the most serious hazard (%)

Field site	Among all hazards	Among all non climate-related hazards
Rajiapur	6	15
Bariakari	15	23
Both field sites	10	18

Similar to health, while respondents often talk about food insecurity as separate from climate, there is a strong link to seasonal weather patterns. Many of the periods of food insecurity identified by the respondents in both sites relate to periods of lack of work that occur between the planting and harvesting seasons of main crops (*aman*, *boro*, maize in Bariakari). This is known in policy and literature as *monga* (Khandker and Mahmud, 2011, 2012; Khandker, 2012; World Bank, 2009), and usually occurs in between September and November, and also sometimes in January and February, with the agriculture-dependent rural poor being most severely affected. While *monga* occurs in both field sites, reportedly causing acute periods of hunger due to lack of income-earning opportunities, the greater reliance on agricultural livelihoods in Bariakari relative to Rajiapur (Chapter 5, Section 5.4, Table 15) could underlie the greater perception of risk attached to *monga* for respondents in that field site. Respondents in both field sites use the word '*ovab'* instead of *monga*, which translates to 'bad situation,' and '*akal'* to describe food insecurity. Some *akal* periods are related to the crop calendar, occurring between harvesting seasons for major crops, and thus corresponding to the *monga* discussed in the literature (Khandker and Mahmud, 2011, 2012; Khandker, 2012; World Bank, 2009; Conroy and Marks, 2008; Zug, 2006). This is in part related to the fact that only a few cash crops are produced in the local area, especially for Bariakari where only maize is produced on a large scale. Other *akal* periods of unemployment arise as a result of seasonal weather patterns and extreme events, such as unavailability of agricultural day labour for long periods of time between June and September/October due to heavy rain, storms, and flooding that submerge agricultural fields and damage crops during this season.

Most respondents do not actually differentiate between the two, reporting instead that they suffer from a six month period of lack of employment, starting with the flood season in June and extending through November due to lack of production. However, most respondents also report that food insecurity during the flood season is more difficult to cope with than food insecurity that results exclusively from lack of work opportunities outside the flood season. This seems to be due to the multifaceted nature of impacts from flooding on livelihoods, which not

only affect food security through lack of work, but also simultaneously affects health status as well as other resources, like housing, livestock, and access to transportation, all of which can act to reinforce food insecurity.

In addition to seasonal periods of unemployment, there is a general trend of increasing underemployment reported by respondents, particularly in the agricultural day labour sector—both river- and farm-based. The first, according to field respondents, is due to changes in the depth of the river, due to soil accretion in riverbeds from erosion, creating sub-optimal fishing conditions. Compounding this, increasingly more people are engaging in fishing to supplement their incomes as opportunities for farm-based agricultural day labour decrease (Aghazadeh, 1994). Additionally, overfishing—particularly during spawning seasons for fish—has led to dwindling fish populations. Akash, a Hindu fisherman in Rajiapur describes these processes:

Box 10: Dwindling fish resources

> Akash (fisherman, Rajiapur): "The fish of the river are decreasing now. The fish has been decreasing from 16 or 17 years ago. The people are increasing now, so the demand is also increasing. So many people are fishing now. Yes, the people are increasing so the fish are decreasing. More people catch fish now. Now both Hindu and Muslims catch fish, before only Hindus caught fish, so there were not so many people catching fish before. People also catch the mother fishes so all the fish are decreasing."

Decreasing availability of farm-based agricultural labour, according to field respondents, is due in part to decreasing amounts of agricultural land from erosion in the immediate field site areas, and across the unions in which field sites are located. Related to this is a trend whereby local farmers own progressively smaller plots of land, resulting both from increasing local populations and high rates of erosion, and are therefore hiring fewer and fewer workers, as individual farms decrease in size. Both of these patterns were identified, but only by respondents in Rajiapur, suggesting that these are issues primarily affecting mainland areas where population density is greater (BBS, 2001).

6.3.4. Poverty and insecurity

In addition to food insecurity, in discussing their perceptions of risks to their livelihoods, many respondents raised other elements of insecurity that are related to poverty. These have to do, for instance, with lack of access to productive resources and income-earning opportunities that provide enough income to break out of extreme poverty:

Box 11: Money only for food

Hasan (fisherman, Rajiapur): "I have no money, I have nothing, what will I do? Sometimes I think I will do this or that, but I have no money and no resources, so I can't… We are poor people. Whatever we earn, we have to spend to eat food, so we cannot prosper in our lives, we have nothing, no land or livestock."

Some of the other individuals reporting poverty and insecurity as their greatest challenge spoke about it in terms of being alone, lacking family networks to fall back on for support. Most of these, not surprisingly, are older widows, whose children are grown but unable to support them due to their own poverty. For the most part, they relate this type of insecurity to having lost their husbands.

Box 12: 'I am alone. I have nobody'

Trina (beggar, Rajiapur): "I am alone, nobody with me. I have nobody after my husband death. My sons are not take care of me. So I went to Feney to earn money with begging and maidservant work. I must manage somehow."

Jamila (maidservant, Rajiapur): "My husband died long ago. Also my son, father-in-law, mother-in-law, everyone died. I am here now still… My house fell during storm last year, now I live here in the house of my Nephew, he is in Dhaka now. When he comes I must leave again. Where will I go? I have nobody. *Ami dukkhito* (I am suffering/distressed)."

Of all responses about hazards, six per cent of those in Rajiapur and seven per cent in Bariakari rate poverty and insecurity to be the greatest challenge they face; among all non climate-related hazards, 19 per cent of responses in Rajiapur are about poverty and insecurity, and 15 per cent in Bariakari.

Table 23: Share of responses rating poverty and insecurity as the most serious hazard (%)

Field site	Among all hazards	Among all non climate-related hazards
Rajiapur	6	19
Bariakari	7	15
Both field sites	7	18

Some of the other drivers of vulnerability that were mentioned by respondents include conflict over land ownership, usually with other family members (both field sites), and lack of access to clean water and sanitation (only in Bariakari).

6.4. Interaction of climate and non climate-related sources of risk and vulnerability

One aim of this research has been to explore where climate-related sources of risk and vulnerability fall in the wider vulnerability context, i.e. whether climate-related hazards in general are perceived to comprise the greatest source of risk and vulnerability among field respondents, or if other, non climate-related sources of risk present greater challenges to local livelihoods. Related to this has been the objective of exploring the ways in which climate and non climate-related risks and shocks interact with one another, for example how certain effects from climate-related shocks, such as flooding, may compound the effects of other, non climate-related shocks or stresses, such as complying with dowry requirements (Section 6.3.2).

While interaction of multiple stressors may have always been a characteristic of extremely poor households in Bariakari and Rajiapur, what heightens the importance of a focus on the role of climate within this vulnerability context, is the extent to which climate variability and extreme events may be changing—and the pace of change. This will be re-visited in Section 6.5 below, where findings around local perceptions of climate change and the livelihood impacts from perceived changes, are presented. The rest of this section analyses data around perceptions of interactions between climate and non climate-related sources of risk and vulnerability, and the various factors that underpin perceptions of risk respondents attach to different kinds of hazards.

As illustrated in Figures 8 and 9 below, on aggregate, non climate-related hazards are perceived as posing a greater challenge to maintaining livelihood security among respondents, although not by much. Slightly more than half (51 per cent) of responses across both sites indicate that

the non climate-related sources of risk discussed in the sections above are altogether more challenging than the climate-related sources of risk.

Figure 8: Distribution of climate-related main hazards (% of responses)

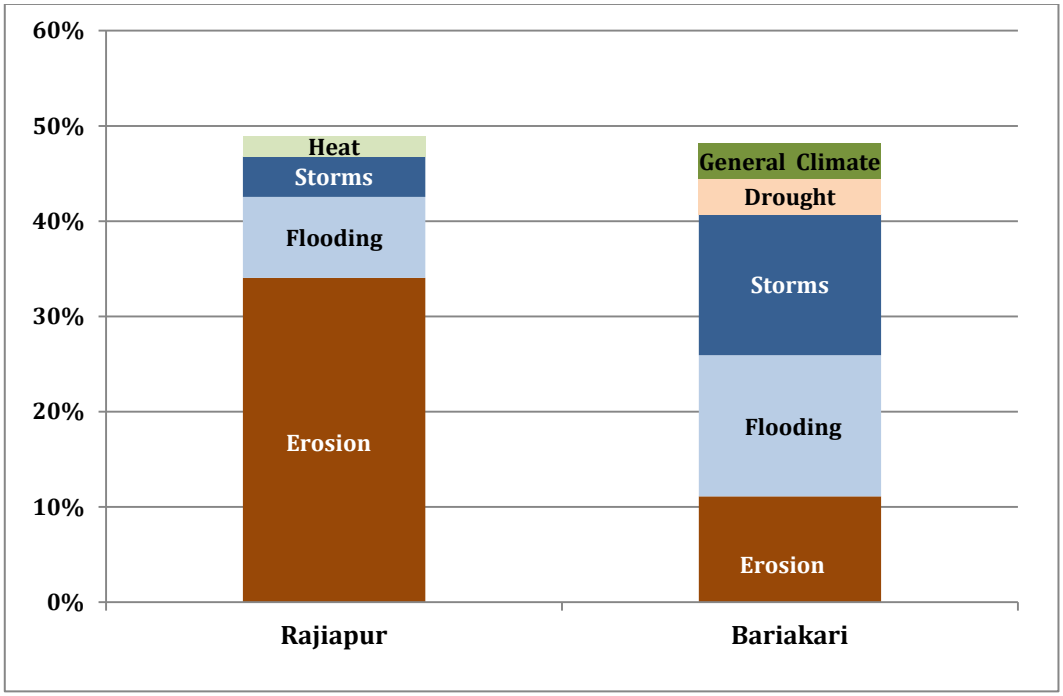
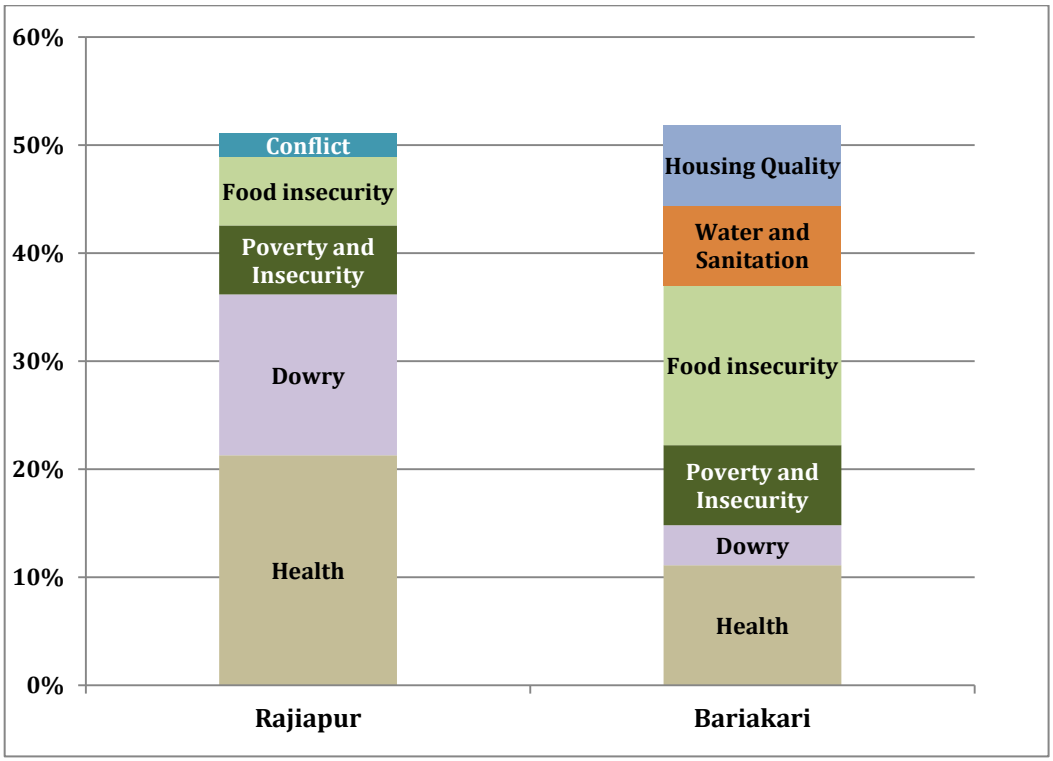


Figure 9: Distribution of non climate-related main hazards (% of responses)



Disaggregating these numbers provides important insights. Erosion received the highest number of responses to the question of greatest overall hazard—no single other category of hazard, climate or non climate-related, received as many responses. A majority of these responses are from Rajiapur, where erosion is clearly perceived to be a much greater source of risk to livelihoods than in Bariakari. After erosion, the next category in terms of frequency of responses is health shocks (18 per cent of responses across all hazards), with more respondents perceiving it as a major risk in Rajiapur than in Bariakari. Dowry and flooding were rated as the worst overall hazard by 11 per cent of responses, with dowry perceived as a far greater risk among the Rajiapur responses than for Bariakarians; for flooding, the reverse is true. The next largest share of responses report food insecurity to be the greatest hazard. Finally, storms and poverty/insecurity each received 7 per cent of all responses in regards to greatest overall hazard, with both perceived to be a greater risk in Bariakari than in Rajiapur.

Table 24 disaggregates responses concerning perceptions of risk to livelihoods for the six hazards identified as the greatest overall (erosion, health shocks, dowry, flooding, food insecurity, and storms). It summarizes the various climate and non climate-related factors that underpin the main livelihood impacts and perceptions of risk for each site, thus revealing some of the reasons for differentiation in perceptions of risk between the two sites.

This illustrates a central finding of this research: that perceptions of vulnerability can be significantly different, even between two sites that are located in neighbouring unions, in the same district, subject to the same weather conditions, and to broadly the same policy, governance, and socio-economic environments. This provides empirical support for the oft-made claim that vulnerability is highly context specific, and underpinned by factors both climate and non-climate related.

Furthermore, as indicated in sections above, there is a great deal of overlap and connection between climate and non climate-related sources of risk and vulnerability. For example, health shocks, food insecurity, and decreasing work opportunities all have strong climate-related dimensions. Conversely, the ways in which different climate-related hazards are perceived and acted upon (or not) are related to the context in which they occur (including access to resources, policy context, e.g. NGO programmes and government safety nets) (elaborated in Chapter 7).

Table 24: Factors underpinning perceptions of risk in Rajiapur and Bariakari

Hazard	Perception as worst among all hazards (%)	Perception as worst hazard of its kind (climate or non-climate) (%)	Livelihood impacts	Climate-related factors[64]	Non climate-related factors
Erosion ***Both sites*** ***Rajiapur*** ***Bariakari***	 **26%** **34%** **11%**	 **52%** **57%** **46%**	Loss of homestead and agricultural land Destruction/damage to infrastructure and other resources (e.g. tube wells, latrines) Conflict over land; conflict over grazing animals	Flooding and heavy rainfall Soil quality	Proximity to riverbank Population density/ease of finding new land (greater challenge in Rajiapur) Experience coping with erosion (greater in Bariakari) Degree of collective coping (greater in Bariakari)
Health shocks ***Both sites*** ***Rajiapur*** ***Bariakari***	 **18%** **21%** **11%**	 **31%** **35%** **24%**	Loss of work/income Expenditures on treatments/medications	Adverse weather/extremes can cause sickness and injury	Access to health services (more NGO-sponsored health programmes in Bariakari)
Dowry ***Both sites*** ***Rajiapur*** ***Bariakari***	 **11%** **15%** **4%**	 **18%** **23%** **8%**	Impoverishment long- or short-term depending on size of dowry;[65] shame if unable to marry off daughters	None—other than coincidence of climate-related shocks and dowry obligations	Cost of dowry Work availability and daily income Number of marriage-age daughters (greater in Rajiapur)

[64] The factors listed in this column are not strictly climate-related; they also have manmade dimensions. For erosion, for example, soil quality is related to land use patterns as well as the pattern of flooding and rainfall. Flooding itself is influenced by both climatic and non-climatic factors; the latter related, for example, to manmade river control mechanisms.

[65] Long and/or short-term impoverishment is arguably a livelihood outcome from most of the hazards listed in Table 24.

Flooding ***Both sites*** ***Rajiapur*** ***Bariakari***	 **11%** **9%** **15%**	 **27%** **28%** **24%**	Replenish soil nutrients (only normal flooding) Destruction/damage to household resources and infrastructure Disease and injury (humans and livestock) Loss of work opportunities Children unable to attend school	Severity, timing, and duration of flooding	Ability to raise homestead land (land tenure)[66] HH division of labour (women spend prolonged time in floodwater, greater health effects) Access to flood relief[67] Primary livelihood activity (agriculture most affected)
Food insecurity ***Both sites*** ***Rajiapur*** ***Bariakari***	 **10%** **6%** **15%**	 **18%** **15%** **23%**	Lower general health, malnutrition	Adverse weather/extremes during planting/harvest seasons for main crops	Number of cash crops (fewer in Bariakari) Degree of reliance on agriculture (greater in Bariakari)
Storms ***Both sites*** ***Rajiapur*** ***Bariakari***	 **8%** **4%** **15%**	 **15%** **11%** **21%**	Destruction/damage to infrastructure Human/livestock injury Children unable to attend school	Severity of storm	Housing quality Primary livelihood activity (river-based more at risk during storms) Access to solid structures for shelter (only in Rajiapur)

[66] This is discussed in greater detail in Chapter 7, Section 7.2.1.
[67] This is discussed in greater detail in Chapter 7, Section 7.2.1.

6.5. Perceptions of change

This section introduces data on perceptions of change among respondents with respect to both the climate-related shocks and stresses introduced above, and their own poverty status in recent years. As part of household interviews, each respondent household was asked whether its situation (*obosta*—life condition) had improved or worsened over the last 10 years, and the main factor to which they attribute this change. For 10 individual respondents, life history interviews were also carried out, and these allowed for a more in-depth exploration of poverty dynamics over the course of the respondents' entire life trajectory. These interviews, and questions about change over time for the larger respondent group, aimed at understanding the role of climate-related shocks, relative to other kinds of shocks, in shaping changes in respondents' lives over time. Section 6.5.1 presents findings about respondents' perceptions about changes in climate, Section 6.5.2 about their perceptions of changes in poverty.

6.5.1. Perceptions of change in climate and associated livelihood impacts

The sections above discussed the ways in which climate and weather have historically affected livelihoods in Rajiapur and Bariakari. This section presents findings on respondents' perceptions about *changes* in those long-term trends, and how these changes affect their livelihoods.

Many respondents perceive that changes have been occurring in the weather patterns and climate-related extreme events discussed above. While there is some divergence of opinion, changes are generally perceived to be occurring both in relation to (1) extreme weather events—flooding, erosion, and storms, mainly in terms of timing, duration, intensity, and frequency; and (2) weather and seasonal patterns of temperature, rainfall, and drought.

6.5.1.1. Changes in extreme events—flooding, erosion, and storms

Perceptions of change in flood patterns are somewhat divergent: most respondents who perceive some change think flooding has increased (63 per cent); 17 per cent think it has decreased; 11 per cent think floods are becoming more erratic; 23 per cent think that they are starting earlier and/or lasting longer); and 19 per cent perceive no change in the incidence or pattern of flooding. The most commonly reported change among the respondents is that flooding is increasing, followed by shifts in timing, and increased frequency and duration.

In relation to timing, the normal flood season occurs during the monsoon (*Borsha*) from mid-June through mid-August. However, respondents in both field sites report that over the past decade, floods have been occurring outside this regular flood season—starting as early as mid-April and recurring sometimes as late as November. With this, floods are occurring between three and five times during the flood season, where in the past they occurred between one and three times. While respondents have mixed perceptions about whether the severity of regular annual floods has changed, most report that the incidence of severe flood events has increased. In the past, severe floods happened every five or seven years, and now they occur every two or three years. Many respondents report that the duration of normal, annual floods (i.e. not severe floods) has also increased, meaning that the number of days floodwater stays before receding has increased. In the past it was customary for floodwater to recede rapidly, usually between two and five days after a flood occurred; now this period is longer, sometimes up to 15 days.

These changes have wide-ranging effects on livelihoods. Cropping patterns in both field sites have shifted due to changes in the flood pattern, which, in turn, changes the pattern of availability of agricultural day labour. For instance, *aman* paddy is traditionally transplanted to new fields in mid-September, after the end of flood season; now when *aman* seedlings are replanted at this time, it is common for floods to occur again after mid-September and destroy seedlings. This affects working opportunities for day labourers, and is devastating for extremely poor families engaged in sharecropping, as Farida, a staff member of GUK working in Rajiapur explains:

Box 13: Floods are more frequent and last longer

> Farida (staff member of GUK, Rajiapur): "Floods are more frequent now: 10 or 12 years ago the floodwater would stay for maybe one or two days but now there is stagnant water that stays for 10 or 15 days, and then after that water goes away another flood will happen 10 or 15 days later, and destroy paddy seedlings. When a flood destroys the paddy this totally destroys the family because they invest all their money in this paddy—this is one of the main reasons people are getting poorer, if their paddy is destroyed and they want to plant more they need to take a loan from the moneylender. Sometimes they pay moneylenders back with a combination of money and rice, and this is very difficult if the paddy fails."

Boro paddy is also affected by changes in the timing of flooding, since it is usually harvested before the flood season begins, between mid-April and mid-June. With floods beginning earlier, entire *boro* harvests can be destroyed, spelling disaster for day labourers as well as those invested in sharecropping. Longer periods of flooding in general mean that agricultural day labourers are out of work for more time. Extremely poor families must either save more money

before floods begin, to be able to buy food for relatively longer periods of time (which is difficult given low daily wages), and/or borrow more money than usual during the flood season. Men who migrate during the flood season usually plan to do this right before flooding starts, but with floods beginning earlier than normal, they sometimes do not leave before the first flood hits, and can get stuck, without work, in the local area when roads become unusable.

For fishermen, conditions on the river are both more dangerous (with high tides and heavy currents) and less productive (with more water making it harder to catch fish) for fishing during floods. Longer lasting and more frequent flooding prolongs this challenging period for fishermen. Those engaged in sharecattling also suffer, since they have to find grass to feed their animals during longer and more frequent floods. However, not all livelihood activities are negatively affected by longer and more frequent flooding. Dewan, a boat driver in Bariakari, reports that the longer a flood lasts, the better for him and the higher his daily income, since he stays very busy transporting people and goods at this time. Of course this is not the case when storms and heavy rainfall coincide with flooding, making conditions on the river too dangerous for boat transportation.

Households, including vegetable gardens, are more prone to destruction when communities are flooded for longer periods of time. Bamboo pillars and *shon* and jutestick walls have to be replaced more often. Respondents spend longer periods of time in contaminated floodwater, leading to increased incidence of disease. This is particularly true for women, who spend relatively more time in floodwater engaged in household chores. The burden of sourcing safe drinking water during longer flood seasons, including travelling far distances to raised tube wells, also falls on women and girls.

Perceptions of change in erosion are less divergent than are those for floods. About erosion, 82 per cent report an increase,[68] 14 per cent report an increase in the unpredictability of erosion, and another 14 per cent perceive no change. In the past, erosion occurred mainly between June and September, but now it frequently occurs for longer, due to longer flood seasons. Erosion patterns are also becoming increasingly erratic, sometimes occurring all the way through December, as well as during totally unexpected months. For instance, between March and May of 2009, Rajiapur experienced a great deal of erosion, completely unrelated to flooding. Loss of agricultural land on a wider scale means fewer work opportunities for agricultural day labourers:

[68] This matches up with historical data on erosion patterns, which have exhibited an increasing trend over recent decades in Gaibandha (Uddin and Basak, 2012) (Chapter 4, Section 4.6.4.1).

Box 14: Land is becoming scarce

> Megh (agricultural day labourer, Rajiapur): "Because of riverbank erosion people are losing their lands, so the total amount of land is decreasing, and because of this farmers are having less and less land, so they work for themselves in their smaller pieces of land, they don't hire people, so the work is less for us."

Perceptions of change in storm patterns are highly divergent: 33 per cent of responses report an increase; 22 per cent a decrease; 22 per cent report that storm patterns have become more erratic; and 22 per cent report no change at all. Those respondents perceiving an increase in storms and more erratic storm patterns indicate that these changes have led both to increasing destruction of and damage to household resources from storms.

Table 25 below summarizes for each site the share of responses regarding perceptions of changes in the extreme weather events discussed above. The site-specific perception data indicate that perceptions of some changes are broadly similar across the two sites: that flooding, erosion, and intensity of storms have increased, and that storm patterns have become more erratic. On the other hand, some areas of perception are rather more divergent between the two sites, most notably: that there has been no change in the flood pattern (far more Rajiapur-based responses indicate no change in the flood pattern than do responses in Bariakari), and that erosion has become more erratic (a more popular perception in Bariakari).

Analysis of all the factors underpinning divergent perceptions of change is beyond the scope of this research, however based on a review of some of the most common perceptions of change, together with the data presented in Section 6.4 on perceptions of risk attached to different hazards across the two field sites, some preliminary conclusions may be drawn regarding implications for livelihoods. For instance, in both sites (1) erosion is perceived by a large share of respondents as a major hazard, and (2) a large share of responses about perceived climate change also indicate a perceived trend of increasing erosion over recent years; hence, it could be concluded that the livelihood effects from erosion in the context of accelerated climate change may well become an even greater source of impoverishment for extremely poor communities in the fieldwork areas. Similar conclusions could be drawn for flooding in both sites, and for storms, particularly in Bariakari where respondents already face significant barriers to successful coping given the lack of adequate shelter.

Table 25: Perceived changes in extreme weather events

Extreme weather event	Perceived change	% of responses regarding perceived change	Livelihood impacts from perceived change
Flooding ***Both*** ***Rajiapur*** ***Bariakari***	**Increase**	**63%; 62%; 65%**	Greater destruction of household resources, infrastructure; increased incidence of flood-related diseases; greater challenges sourcing food/water for livestock; more time out of school for children; fishing more difficult/dangerous; less agricultural work; more work for boatmen
	Decrease	**17%; 14%; 24%**	---
	More erratic (starting earlier/ ending later)	**37%; 41%; 29%**	Decreased predictability of agricultural work due to effects on cropping patterns for *aman*, *boro*; harder to plan migration before flood season
	No change	**19%; 24%; 6%**	---
Erosion ***Both*** ***Rajiapur*** ***Bariakari***	**Increase**	**82%; 82%; 83%**	Increasing incidence of social conflict over land
	More erratic	**14%; 9%; 33%**	Less predictable, higher incidence of loss of HH resources
	No change	**14%; 14%; 17%**	---
Storms ***Both*** ***Rajiapur*** ***Bariakari***	**Increase**	**33%; 39%; 22%**	Greater destruction of HH resources
	Decrease	**22%; 17%; 33%**	---
	More erratic	**22%; 22%; 22%**	Decreased predictability and therefore less able to engage in risk management (finding shelter)
	No change	**22%; 22%; 22%**	---

6.5.1.2. Changes in weather patterns and seasons

Respondents report that overall weather patterns and seasons are also shifting, particularly rainfall and drought. Eighty-three per cent of respondents who believe there is a change report that drought is increasing; 67 per cent indicate rainfall is decreasing, and 27 per cent report that it is becoming more erratic, occurring outside normal times and often in shorter and more violent bursts that damage crops. Steady amounts of rainfall are expected during the rainy season between June and August; however rains no longer follow this pattern. There are now fewer days of rain, but it is more intense during those days, with the total amount of rainfall throughout the rest of the year seemingly decreasing. Several respondents say that rainfall used to occur more regularly throughout the year in the past, with at least some falling during most months. Now, it is common for three or four months to pass with no rain. This is particularly damaging to rain-fed crops, such as jute, and for the day labourers who depend on this work:

Box 15: Changes in weather affecting the jute crop

> Mubina (agricultural day labourer, Rajiapur): "In the month of *Choitro* [mid March to mid April] we plant jute seeds and when it grows, farmers hire us for weeding the land. But now during *Choitro* there is no rain so people can't sow seeds of jute, so the landowners can't hire us and we are jobless."

When drought is severe and the water level in the river decreases, income for boatmen is also affected, since fewer people need to travel by boat. Fishermen, on the other hand, have an easier time catching fish when water levels are lower, as long as the river does not dry entirely, which, however, sometimes occurs. On the other hand, when rainfall occurs intensely during shorter periods of time, especially when it coincides with flooding, waterlogging can be severe and also damage the jute crop.

Perceptions about increasing drought are consistent with data; for instance Rajib and colleagues (2008) report that the incidence of severe drought in the Rajshahi-Rangpur region has increased over the last two decades, compared to the 1960-73 period. However, perceptions about rainfall are at odds with the meteorological record, which indicates that a general increasing trend over Bangladesh in recent decades has actually been greatest in the Northwest region (Shahid, 2010) (Chapter 4, Section 4.6.4.2).

Shortage of rainfall increases the need for irrigation, which creates jobs for day labourers. However, it also increases the investments necessary for sharecroppers to secure a decent yield,

since they more frequently have to rent shallow water machines for irrigation. Due to lack of rain during summer months, according to respondents, mosquitoes and other insects are increasing in numbers. For those who own livestock or engage in sharecattling, longer periods of drought, similar to longer flood periods, make finding sufficient food for livestock even more challenging, since grass also dies from drought and lack of rainfall. In general, viability of crop production cycles based on historical weather patterns, and the general patterns of availability for different livelihood activities that depend on these, have become much less predictable over the past decade.

In addition to changing rainfall and drought patterns, 26 per cent of responses about climate change indicate that seasons and temperature trends are shifting:

Box 16: Changes in the seasons

> Parvez (farmer, Rajiapur): "We cannot feel the six seasons now. Before, every two months the seasons were changing. But now there are not six seasons. We can feel the winter six months, the dry season four months, and the rainy season two months of the year. And the rainy season is not coming in regularly or at the normal time."

Respondents in both locations report both hotter and longer summers, which before used to last for two months (mid-April to mid-June) but now begin a month earlier, in mid-March. Of respondents who report a change in temperature, 48 per cent indicate an increasing trend in hot weather. This matches with historical data indicating that temperature has increased in Bangladesh over recent decades (CCC, 2009b; Islam and Neelim, 2010; Islam, 2009; Rajib et al., 2008; Shahid, 2010; Yusuf et al., 2008), and that the greatest increase in temperature has been recorded in Bogra, the weather station located closest to both field sites (Islam, undated). Hotter conditions are particularly difficult for older individuals, those with health problems, and young children to endure, and make it very difficult to complete an entire day of agricultural labour in the sun. Winters are also becoming colder. Nineteen per cent of respondents reporting changes in temperature indicate an increase in extreme cold temperature, with temperatures dropping lower than in the past during the months of mid-December to mid-February. This, in turn, often kills homestead vegetables and crops, and leads to higher incidences of cold, fever, and general ill health during winter months, since respondents generally lack adequate clothing and blankets to endure increasingly colder conditions.

Table 26 summarizes for each site the share of responses regarding perceived changes in the weather and seasonal patterns discussed above. The data presented indicate that certain

perceptions of change are more common across the two field sites than are others. Most notably, the perception that drought is increasing seems to be the most convergent of all perceptions across the two field sites. However, given that a smaller share of respondents seem to think of drought as posing a major risk to livelihoods relative to other hazards (and these are concentrated among Bariakari-based respondents involved in cultivation) (Section 6.2.4), the broadly perceived increasing trend in drought may not be associated with livelihood risk under accelerating climate change, insofar as the respondent groups are concerned. This is likely related to the fact that, for one, while drought has been perceived to be increasing over recent years, it has not yet reached the level of posing major threats to water supply for household use. Regarding agriculture, given that the core respondent group is extremely poor and therefore tends to be engaged mainly in day labour (Chapter 5, Section 5.4.1, Figures 5 and 6), the main implication may actually be increasing work opportunities associated with increasing use of irrigation, rather than greater losses due to crop yield failures.

Table 26: Perceived changes in weather and seasonal patterns

Weather/ seasonal pattern	Perceived change	% of responses indicating perceived change	Livelihood impacts from perceived change
Rainfall ***Both*** ***Rajiapur*** ***Bariakari***	**Increase**	**2%; 3%; 0**	More flooding and erosion
	Decrease	**67%; 58%; 82%**	Increased drought and incidence of crop failures if severe; if not severe, increased work for agricultural day labourers due to need for irrigation; more resources needed for cultivation
	More erratic	**31%; 19%; 53%**	Increased incidence of crop failures, less predictable agricultural work
	No change	**15%; 23%; 0**	---
Drought ***Both*** ***Rajiapur*** ***Bariakari***	**Increase**	**83%; 76%; 100%**	Increased incidence of crop failures if severe; if not severe, increased work for agricultural day labourers due to need for irrigation; more resources needed for cultivation; more work for fishermen unless severe drought; less work for boatmen; increased burden on women/girls sourcing HH water and food for livestock (grass dies)
	More erratic	**3%; 3%; 0**	Increased incidence of crop failures, less predictable agricultural work
	No change	**15%; 21%; 0**	---
Temperature/ seasonal weather ***Both*** ***Rajiapur*** ***Bariakari***	**Hotter temperatures in summer**	**48%; 42%; 21%**	Increasingly difficult to work during extreme heat (elderly/sick); lack of shade in Bariakari (no trees)
	More hot days	**8%; 5%; 5%**	Greater incidence of sickness and destruction of crops
	Colder temperatures in winter	**16%; 21%; 0**	Greater destruction of crops and homestead vegetables; higher incidences of cold, fever, and general ill health during winter months
	More cold days	**4%; 0; 5%**	
	More extreme hot and more extreme cold	**12%; 11%; 5%**	
	No change in temperature patterns	**15%; 21%; 0**	---

6.5.2. Changes in poverty

Respondents were asked during household interviews to discuss any changes in their household condition (*obosta*) over time—whether they felt it had improved, worsened, or stayed the same. Asking about long time scales proved less effective in terms of identifying specific drivers of poverty and vulnerability, so respondents were instead prompted to discuss the last 10 years. The 10 life history interviews collected allowed for greater depth in probing poverty dynamics over longer time scales, i.e. the entire life trajectory of the respondent, as well as exploring how the inter-relationships between different kinds of shocks and stresses underpin poverty dynamics over time.

Generally respondents perceive that their households have become more impoverished over the last 10 years:

Table 27: Change in poverty in Rajiapur and Bariakari over the last 10 years

	Rajiapur		Bariakari		Both field sites	
Change in poverty	**Number of HH's**	**(%)**	**Number of HH's**	**(%)**	**Number of HH's**	**(%)**
Increase	22	(85%)	10	(67%)	**32**	**(78%)**
Decrease	4	(15%)	3	(20%)	**7**	**(17%)**
No change	0	(0%)	2	(13%)	**2**	**(5%)**
Total households	**26**		**15**		**41**	

Between the two field sites, a higher share of Rajiapur-based households feel that they have become worse off than do households in Bariakari (85 per cent vs. 67 per cent of the respondent group in each site); conversely, a larger share of respondent households in the latter site reports having decreased their poverty levels over the last 10 years, and the only households reporting no change are in Bariakari.

Tables 28 and 29 below illustrate the perceived causes of changes in poverty for Rajiapur and Bariakari, respectively.

Table 28: Rajiapur perceived causes of changes in poverty

Change in poverty (total no. HHs)	**Absolute number and share of descending/ascending HHs by cause (%)**
Increase (22 total)	Erosion – 9 (41%) Health – 4 (18%) Increased dependency ratio – 4 (18%) Dowry payment – 2 (9%) Conflict over land – 2 (9%) Widowhood – 1 (5%)
Decrease (4 total)	Decreased dependency ratio – 3 (75%) NGO support – 1 (25%)
No change (0)	---

Table 29: Bariakari perceived causes of changes in poverty

Change in poverty (total no. HHs)	**Absolute number and share of descending/ascending HHs by cause (%)**
Increase (10 total)	Erosion – 5 (50%) Widowhood – 3 (30%) Loss of better job – 1 (10%) Dowry payment – 1 (10%)
Decrease (3 total)	Decreased dependency ratio – 3 (100%)
No change (2)	---

Of the seven households reporting *decreasing poverty* levels over the last 10 years, four are in Rajiapur and three in Bariakari. Most of them (six) report a decreased dependency ratio as the main underlying factor (75 per cent of ascending households in Rajiapur and 100 per cent of ascending households in Bariakari). These are households in which children became old enough to work full time and contribute to household incomes. Three of these households live in Bariakari and are engaged in sharecropping, and all three currently produce maize. While these respondent households did not themselves report the adoption of maize production as the reason their poverty has decreased over the last 10 years, this may be playing a role, since it was introduced in the area about six or seven years ago, and has proven to grown well in sandy, drought-prone *char* areas, providing a major cash crop for these respondents. The seventh household whose poverty has decreased identified involvement with a local NGO programme as the main reason for improvement. This household is located in Rajiapur.

In terms of *impoverishment*, erosion was identified more than any other factor as the main driver in both sites: 41 per cent of descending households in Rajiapur and 50 per cent of descending households in Bariakari. Thereafter, cited drivers of impoverishment differ between the two sites: in Rajiapur, health status (including injury, sickness, and physical inability to work due to general poor health/old age) and increased dependency ratio each account for 18 per cent of descending households, followed by dowry payments and conflict over land (each accounting for nine per cent of descending households), and widowhood, accounting for the final five per cent of households descending into poverty over the last 10 years. In Bariakari, after erosion, main drivers of impoverishment include widowhood (30 per cent of descending households), loss of better (i.e. higher paying) job, and dowry payment (each comprising 10 per cent of descending households.

Taking the data provided in Tables 28 and 29, together with that provided in Sections 6.4 and 6.5.1, it becomes clear is that erosion is thought of more than any other climate related factor that has driven impoverishment among respondent households over the last 10 years. This may be explained by the fact that erosion is thought of as posing a major risk to livelihoods relative to other climate (and non climate-related) hazards across both sites.

However, while respondents clearly perceive erosion as the most challenging hazard they face, both in terms of having caused impoverishment in the past and in terms of the risks they attach to hazards going forward, during interviews respondents also indicated that it was more often the interaction of several different shocks and stresses, and the need to cope with multiple stressors, that ultimately leads to impoverishment. The discussions with Rehena and Maliha in Box 17, and the life history interview with Refat in Box 18 are reflective of these sentiments.

Box 17: Multiple interacting shocks

Rehena (agricultural day labourer, Rajiapur): "I had land before moving here, in Vati Kamari. When my husband was alive we hired labourers to work, had cows, we were in much better position ten, maybe 15 years ago. But river took everything, all the land is in the river now and we became in much worse position… One year after erosion my husband died. He suddenly got a pain in his stomach, we went to the doctor, he took medicine, we took *dena* for this and had a lot of *kosto* for his treatment, but still he died… Now I am completely alone, I do agriculture work, weeding, separating corn from the husk, these things, but sometimes there is no work, I just sit in my house. If I can't work I can't manage food. There is nobody to help me… My husband is gone, my land is gone. I am alone now."

Maliha (agricultural day labourer, Bariakari): "We are in worse position now. Before government gave us *khas* land and in that time we were better. All of our children stayed with us here then, they worked and we worked in this land… Seven years ago the *khas* land eroded into the river, this land is all gone, now we both do agricultural day labour. He fishes with boat too… All our children are grown now. They don't give help, send money, they are married, they have children. They do not help us now. In these ways we are more poor now. Our children don't help, we have no land, we have nothing."

Life history interviews were undertaken with 10 individuals, six in Rajiapur and four in Bariakari. These interviews illustrate similar patterns, of the inter-relating, self-reinforcing nature of the multiple shocks and stresses respondent households confront, over longer trajectories, i.e. the entire life of a respondent. The life history of Refat is included below, as an example of the life trajectory of one respondent.

The life history interviews illustrate how the climate-related shocks and stresses respondents experience are so damaging because they happen in a context of multiple stressors, the effects from which often reinforce one another (O'Brien et al., 2004). Coping with some sources of risk and vulnerability often makes respondents more vulnerable to others—for instance, in Refat's case, having sold the tin from his roof to pay for his daughter's dowry has made him and his family more vulnerable to the effects of rain, flooding, and storms.

Box 18: Life history of Refat

Refat is approximately 55 years old,[69] and lives with his wife and three children in Rajiapur. They have seven children in total; three are living and working in Dhaka and one has married and lives elsewhere in Rajiapur. They own no agricultural land. Their homestead land belongs to a local landowner, although they do not pay rent. Refat's main source of income is driving a rickshaw to transport people and agricultural goods. He supplements this work throughout the year with fishing. His wife, Mubina, works as an agricultural day labourer, engages in government-run public works programmes when these are available, and does maidservant work when neither of these are available.

As a child, Refat lived in another village on the mainland, near to Rajiapur. At the time, his father owned agricultural land and he recalls his family being better off throughout his childhood than he is currently in now. He attended school but did not complete class 1; this was not due to lack of financial resources but because the schoolteacher beat Refat one day very badly for misbehaving and he never returned. He is still illiterate. When he was about 16 or 17 years old, his father's land began to erode; within a few years it was completely gone. He recalls this as having increased his family's poverty significantly, and he and his father, along with his two brothers, began working as agricultural day labourers. Some time later, around 1984, he got married to Mubina, which he describes as a very happy event in his life. He and his wife had managed to purchase a small piece of land in Rajiapur on which they built their home shortly after marrying. They began having children soon after moving to their new home.

Four years after moving, Refat and his wife were badly affected by the 1988 flood. For several weeks, he was unable to engage in the agricultural day labouring he had been doing. Just as the flood was receding and life was returning to normal, erosion hit his part of the village badly, and they lost their homestead land. While the effect of the flood had been severe, Refat explains that it was the erosion following the flood that really knocked him and his young family down into severe poverty. The fact that he had been unable to work for weeks before the erosion because of flooding, and therefore had taken money on interest to buy food (having little savings, given low daily wages), made it all the more difficult to cope with the losing their land.

After the erosion, they moved to another part of Rajiapur Village, next to the river (as their first piece of land had been) onto land owned by a friend of his father's who did not ask to pay rent. They lived here for several years, and immediately after the 1988 erosion, Refat started migrating to other districts for agricultural and construction work. He explained that because his daily income was much higher in other districts, this helped them tremendously in repaying the loans they had taken during the flooding and erosion of 1988. Refat continued to migrate for the next 12 years, during which period their situation steadily improved. However, Refat and his wife made the decision around 2000 that he would stop migrating; on a trip to Dhaka, the bus Refat was on was involved in an accident. While it only left him slightly injured, the danger of travel by bus, particularly the cheaper bus services that he was able to afford (which reportedly employ very low paid drivers with little experience, many of whom don't have a licence), was too great for him to keep risking his life.

By this time, around 2000, he and his wife had four children. As some of them were still very young, his wife could not work, and over the couple of years after Refat stopped migrating, their poverty began to steadily increase. This was because Refat, the sole

[69] Very few respondents know their actual age.

income earner, was now making a lower daily income than he had when migrating, and there were now more mouths to feed at home. In 2002, as their poverty really started to increase, Refat's father fell ill and they spent between 4,000 and 5,000 *taka* treating his sickness before he finally died. This expenditure was split between him and his two brothers, but he still had to borrow money on interest from a local moneylender in order to contribute.

At this point, the older children were old enough to watch over the younger ones, so his wife began working, taking any job she could find. Refat says it was not the money spent treating his father that increased their poverty at that time, but rather having to repay the loans they had taken, which charged very high interest (around 25 per cent per month). For several years they continued in the same condition, with both parents as well as the older children working and contributing to household income.

By 2005, Refat's family had saved enough money that together with taking a loan from a local NGO, they were able to purchase a horse and cart. For the two years following this purchase, their condition improved as Refat was able to make a much higher daily wage from transporting people and goods in the local area. However, in 2007 a bad flood affected the area and the horse got an infection in its leg from standing in contaminated floodwater. Refat borrowed money on interest in order to pay a vet and purchase medicine for the horse, but eventually it died. This had a double impact: they were unable to work during the flood, and had lost the horse—their main income-earning resource for recovering after the flood. After the flood ended, they describe being in a very tough situation. But by now, one of their teenage sons had been living and working in Dhaka as a van puller for some time and was able to purchase a rickshaw for Refat, and the income he made from this work helped his family to recover from the effects of the 2007 flood.

This included not only paying back the loans they had taken to buy food, and medicine for the horse, but also to buy materials to fix their home, since the waterlogging from the flood had been prolonged, and therefore had damaged the walls and bamboo pillars of their home, which needed to be replaced.

Over the years the followed, Refat's family managed to increase their condition slightly, with Refat driving the rickshaw, his wife working regularly, and some of the children also working and contributing. However, in 2009, Refat's eldest daughter got married, and they had to pay 25,000 *taka* as dowry. Refat sold the rickshaw his son had given him, as well as the pieces of tin from their roof, and borrowed money from family, and on interest from local moneylenders to come up with this sum. Refat explained that they are still recovering from the effects of having paid the dowry, in particular of losing the productive and physical resources they sold. Their home, now entirely made of jutestick, requires repair several times throughout the year because it is now more easily damaged by rainfall and storms, as well as during the flood season, when the jutestick walls rot almost immediately from waterlogging. Refat continues to work as a rickshaw puller, but he now rents one, so takes home less income from this work. He and his wife expressed great concern over the fact that their next eldest daughter is already 14, and they will need to find a way to pay a dowry for her in a few years.

In rating the events of his life which most impoverished him and his family, Refat identifies the dowry payment of 2009 as being the worst overall; the next most damaging and hardest to recover from was the death of his horse, followed by the effects of erosion in 1988. In discussing the whole trajectory of his life, he also made the point that had his father's agricultural land not eroded when he was a child, and he had been able to inherit this land, he would probably be in a much better position today.

6.6. Conclusions

This chapter analysed respondent perceptions of climate and non climate-related sources of risk, as well as perceptions of changes in climate and household poverty, or condition (*obosta*), over recent years. The purpose has been to explore the role of climate-related shocks and stresses within the wider vulnerability context with respect to shaping trajectories of poverty and vulnerability over time, and perceptions of risk going forward. The data presented above relate to the following research questions: *What are local perceptions of climate and non climate-related risks. How do climate-related shocks and stresses fit within the wider risk and vulnerability context? What are local perceptions of climate change?*

The main findings of this chapter include: (1) patterns of differentiation exist across respondents in terms of how climate-related hazards affect livelihoods, mainly between different social and livelihood groups. Areas of commonality also exist, and relate to the effects of climate-related hazards on homesteads and household resources. (2) Perceptions of risk and vulnerability are differentiated, both within and across the two field sites. With respect to the latter, Rajiapur-based respondents are more concerned about erosion whereas Bariakarians are more worried about storms. These variations are influenced by non-climatic factors, such as the ability to successfully cope with the impacts from these shocks. For example, storms are likely perceived as posing greater risk in Bariakari given the absence of solid structures on the entire *char* in which to take shelter. (3) Perceptions of climate change are also divergent, however among respondents who do feel general conditions and climate extremes have changed, the main livelihood impact has been felt through decreasing predictability of availability of work. (4) A majority of respondent households in both field sites feel their poverty has increased over the last decade. The effects of erosion in particular, as well as the interaction of multiple shocks and stresses—both climate and non climate-related—were both highlighted as a major drivers of impoverishment.

These findings provide empirical support for the oft-made claim that vulnerability to the impacts from climate variability and change is differentiated, and that this differentiation is underpinned by both climate and non climate-related factors (Field et al., 2012; Eriksen and Silva, 2009). Divergent perceptions of climate change and vulnerability to different shocks and stresses going forward indicate that a range of contextual factors influence how people conceptualize change and perceive the risk attached to different hazards (Kasperson and Kasperson, 1996). The ability to address the effects of hazards (e.g. storms in Bariakari and erosion in Rajiapur) emerges as a central factor in this regard. This is related, in turn, to the

multiple shocks and stresses respondents are dealing with simultaneously, the effects of which often reinforce and compound one another (O'Brien et al., 2004; Eriksen et al., 2008). This underscores the importance situating shocks and stresses within the wider context in which they occur in terms of identifying possible limits to adaptation that may exist for extremely poor people (Brouwer et al., 2007; Adger et al., 2009), and thus where needs exist with respect to vulnerability reduction and adaptation.

Chapter 7:
Coping and adaptive responses among respondents and the role of mediating factors

7.1. Introduction

This chapter analyses the coping and adaptive activities undertaken by respondents in reaction to the impacts of the climate-related hazards introduced in Chapter 6, and the factors and processes that mediate these various responses. Section 7.2 presents the *ex-ante* and *ex-post* (Webb et al., 1992, cited in Ellis, 2000) strategies employed to address the effects of flooding, storms, erosion, and drought. Given the prevalence of perceptions that changes are occurring in certain weather patterns and extreme events, it would be expected that respondents had shifted response behaviours to mitigate the effects of these perceived changes on their livelihoods. However, fieldwork findings indicate that there has been little or no change in the traditional coping strategies undertaken. This suggests that significant barriers (Brouwer et al., 2007; Adger et al., 2007; Adger et al., 2009) to successful coping and autonomous adaptation exist, and that the most prevalent response to shifting climatic conditions among the extremely poor in this research may be to "bear losses" (Smit et al., 2001: 884; Burton, 1996; Burton et al., 1998).

Section 7.3 explores barriers and potential opportunities around coping and adaptation, through analysis of the role of 'mediating factors' in shaping differential vulnerability across respondent households, including ability, willingness, and success in undertaking responses to the impacts of climate-related hazards. Feedback from respondents suggests a mix of tangible and intangible factors and processes that influences both vulnerability and the nature of response. The mediating factors that emerge as especially instrumental in the fieldwork sites include: physical capability and health; community and family networks; political ties and corruption; information about climate and weather; and awareness about climate change and beliefs about its causes. These operate at individual, household, and community levels both by influencing access to resources and by shaping the "motivational context" for adaptation (Haddad, 2005).

7.2. Coping with climate-related shocks and stresses

This section presents the coping and adaptive activities (to the extent that the latter exist) undertaken by field respondents in preparing for, responding to, and recovering from the effects

of flooding, storms, riverbank erosion, and drought. Coping among extremely poor households in both field sites is largely autonomous, but respondents do also rely to varying degrees on some resources and services from the local government and NGOs. Therefore, both autonomous and intervention-based activities are included here. The discussion of coping and adaptation that follows is structured around the following concepts:

Timing and thresholds. "Almost all coping strategies for adverse events which are perceived to have precedents consist of actions before, during, and after the event" (Wisner et al., 2003: 115). While respondents may to varying degrees perceive changes in the rate and nature of climate-related shocks and stresses, these hazards, and thus *ex-ante* and *ex-post* responses, have always existed in the local area. Coping activities in Rajiapur and Bariakari fall into one of three categories with respect to timing: (1) pre-climate-related event risk management; (2) activities undertaken during climate-related events to survive and protect resources and livelihoods; and (3) those implemented as post-event coping, or recovery. These three phases, as well as the concept of *coping thresholds,* are discussed for each of the climate-related hazards mentioned above. A continuum of coping activities begins with 'first line of defence'—i.e. activities that are generally carried out first, usually because they are less costly and do not involve sacrificing resources considered essential for generating future income (e.g. selling income-generating resources). Increasing intensity of climate-related events and greater degrees of impact push coping past successive thresholds into more costly and difficult activities along a coping threshold continuum. This has been described elsewhere as the 'coping sequence' (Blaikie et al., 1994; Corbett, 1988).

Differentiation and commonality in coping. The extremely poor respondent group is heterogeneous, with households and individuals experiencing effects from climate-related events in different ways. This differentiation is often based on variations in principal livelihoods and access to resources across respondents, leading, in turn, to differentiation in levels and patterns of coping. For example, agricultural day labourers, sharecroppers, and fishermen experience different livelihood effects from flooding (see Chapter 6, Section 6.2.1), and therefore engage in different risk management and coping activities. Also, while the severity of climate events may determine the need to move beyond a particular coping threshold into more costly or demanding activities, the suite of resources that households and individuals command also influences their willingness and ability to do so (Ellis, 2000; Swift, 1989; Chambers, 2006). Finally, differentiation also occurs at the intra-household level, because of differences in the roles and responsibilities for coping assigned to different social groups—men, women, and children—closely related to socially-ascribed gender roles (Cannon, 2002; Denton, 2004).

On the other hand, **commonalities** are also found, reflecting common experiences in the way climate-related events affect household resources and basic amenities (e.g. housing, homestead vegetable gardens, etc.). Given this commonality, almost all respondent households engage in certain coping strategies aimed at protecting homes and household resources. And while there is intra-household differentiation of roles (discussed above), patterns do not differ markedly across households.

Typologies developed by Wisner et al. (2003) and Burton and colleagues (1996, 1998) (see Chapter 2, Section 2.5) are helpful in classifying the nature of coping strategies among extremely poor individuals in Rajiapur and Bariakari. Insights from these typologies are relevant to this research and are drawn on in the sub-sections below.

7.2.1. Coping with floods[70]

Respondents engage in a variety of activities to cope with the effects of flooding on their livelihoods: (1) preventive strategies aimed at minimizing the impact (Wisner et al., 2003) and preventing adverse effects (Burton, 1996; Burton et al., 1998) of flooding on important household and livelihood resources, and; (2) addressing the effects of loss of work and income during and after the event.

7.2.1.1. Pre-flood preparation

According to interview data, most respondent households engage in at least some flood preparation activities in the lead up to monsoon season. Activities to prevent or minimize the impact of flooding on homes are common to all respondent households, regardless of the livelihood activities in which they are engaged when flooding occurs. For instance:

- Almost all respondents reinforce the bamboo pillars holding up their homes to protect them from collapse during flooding and the storms that commonly occur during these periods.
- If a household has sufficient resources, repairs are also made to damaged walls (requiring extra bamboo, *shon*, and jutestick) and holes in roofs (with extra pieces of tin) to prevent rainwater from entering during heavy bouts of rainfall.
- All respondent households prepare mobile clay stoves to cook on during the flood season. Stoves are generally stationary, constructed in the ground outside of homes or in kitchen

[70] The section on coping with floods is longer relative to subsequent sections on other climate-related shocks and stresses, because flooding is viewed as one of the greatest climate-related challenges to the livelihoods of respondents in both field sites (see Chapter 6, Section 6.2.1 on flooding). Respondents tend to dedicate more time and energy to coping with floods, and in general respondents spent more time discussing flooding during CVCA activities and in interviews.

huts, but during the flood season cooking is usually done on top of furniture that has been raised above the floodwater level, and when flooding is severe enough to submerge homes, families are often forced to move to flood shelters. Therefore preparing mobile stoves is an important preparation for cooking during flood season.

While all households engage in these preparations, there is an element of differentiation along gender lines at the intra-household level. Men generally carry out repair and reinforcement work that requires physical strength, while women and girls prepare mobile stoves, collect fuel wood and dried food to store for use during the flood season, and prepare the mud foundation of the home by smoothing out any uneven sections and covering the floor with leaves from banana trees.

Another set of pre-flood preventive strategies is aimed at offsetting the effect of loss of work and income during the flood season. Unlike the preparation measures discussed above, there is differentiation across households depending on principal livelihoods group, with the main difference being between those engaged in river-based work (e.g. fishermen and boatmen) and those involved in agricultural work (e.g. agricultural day labourers and sharecroppers). For those in river-based activities, work remains available during floods. Fishermen continue working throughout the flood season, although conditions are more dangerous and incomes are generally lower because fewer fish are caught. For boatmen, the flood season is the most lucrative time of year. On the other hand, there is generally a complete lack of agricultural work when fields are flooded, which happens frequently in both field sites even during regular, annual flooding.

In interviews with households dependent on agricultural work, it became clear that they invest more time and resources in pre-flood preparation activities than do households dependent on river-based work. Agricultural day labourers try to save money and store food in the lead up to the flood season. However, given the low daily wages they can obtain, not a single respondent reported being able to save enough to fall back on throughout an entire flood season, therefore to supplement savings, they also rely relatively more on unofficial community safety nets prior to the flood season. This is dependent on having developed social support networks (Wisner et al., 2003) in the local area through which losses from shocks and stresses can be shared (Burton, 1996; Burton et al., 1998). In both field sites, the *dhar koroj* system operates throughout most of the year, whereby households borrow small amounts of food and money from one another during times of hardship. While this unofficial safety net tends to operate less during flood season, since community members are less able to lend one another amenities and money during covariate shocks (Dercon, 2001), respondents who anticipate a complete lack of income do

borrow food and money from their neighbours in the months prior to the flood season, not for immediate consumption, as is normally the purpose of *dhar koroj*, but for storing to use during floods.

"Mobility," (Agrawal, 2010) or "changing locations" (Burton, 1996; Burton et al., 1998) is another common coping activity undertaken largely by male agricultural day labourers. These respondents migrate in the months before the flood season to work in other districts where daily agricultural wages are higher, in order to save more money for flood season than they could if they worked locally. Daily agricultural wages in the field site areas average about 100 to 150 *taka*, which is just enough to meet daily consumption needs for many respondent households; but for those with high dependency ratios, the amount is not sufficient to meet even family food requirements. Men who migrate usually return home before flooding begins. With floods occurring more and more erratically, however, early onset of the flood season can create challenges in planning when to migrate and return home. Migration during floods is usually avoided, since roads become inundated, making transportation difficult in the wider area around both field sites. It is also considered dangerous to leave one's wife and children alone at this time of year. One commonly reported reason for men staying at home is that thieves are active during the flood season, often pulling their boats alongside homes at night to steal whatever resources they can. It is not uncommon for household members to be injured or killed while trying to protect their belongings.

The aforementioned coping strategies are autonomous. According to CVCA vulnerability matrix activities and household interview data, planned intervention activities would also be important in preparing for floods, but they are not generally available. Respondents across the board identify raising homestead land above the floodwater level as one of the most useful measures to take. There is interest in this activity, which in some respects could be considered more of a medium or longer-term adaptive response than simply shorter-term coping. However, most respondents are unable to raise their own homestead land, since the time out of work and/or the cost of hiring labour is usually more than they can afford. By the time the flood season has begun and they are out of work, the soil is waterlogged and it is too late to begin.

Land tenure presents an additional challenge. Almost none of the respondents own the land on which their homes are built—a very common feature of being extremely poor in the fieldwork area. Some pay rent to landowners, others do not—but many respondents describe a similar 'catch-22' problem whereby investing in raising homestead land improves its value, thus increasing the likelihood of its being claimed back by the landowner.

It is mainly through involvement in anti-poverty programmes that some respondents have managed to raise their homestead land. Six out of a total of seven respondent households with raised homesteads achieved this through involvement in an NGO programme.[71] In Rajiapur, the houses of three respondents were raised under a GUK programme for the hard-core poor that ended a few years ago. In Bariakari, three respondent households were raised as part of the DFID CLP Programme, however according to interviews with local CLP staff, this programme reportedly faces similar land tenure challenges. According to respondents in Bariakari, one dimension the programme failed to incorporate into planning, is consideration of seasonality of local labour availability and therefore failure to offer a daily wage for earth-digging work that is competitive enough to attract sufficient labour to raise all beneficiary homesteads prior to the onset of flooding (Chapter 5, Section 5.4.4).

While, on the one hand, beneficiaries, especially in Bariakari, describe raised homestead land as one of the most important resources for maintaining their livelihoods throughout flood season, the issue of safety sometimes prevents them from staying on their raised patches of land at these times. Families tend to group together during floods as a way to remain safe from thieves. The CLP accordingly raises the homestead land of the immediate neighbours of their beneficiaries, so there is enough room to accommodate several families. However, one respondent whose homestead land had been raised, explained that she was forced to leave during severe flooding anyway, because the amount of raised land between her home and her neighbour was insufficient to accommodate enough community members to be safe against thieves, so all community members had to move to a flood shelter. At the end of the fieldwork period, a local government *monga* eradication programme in Bariakari raised a large piece of land in the middle of North *para*, and a local NGO built a school-cum-flood shelter on it. This helped to ameliorate the problems described above to a certain extent.

7.2.1.2. Coping during flood season

Once flooding begins, households undertake certain common activities:

- Makeshift boats are made out of banana plants, which can be used for transport to markets and as bathrooms (dry open spaces that are normally used during the rest of the year disappear in flood season). Men, women, and children alike participate in constructing these makeshift boats. Because Bariakari is a newly risen *char*, there are no banana plants, and trees in general do not grow well there, but community members

[71] The seventh respondent household had managed to raise its own homestead land; they live in Bariakari and have nine children, all of whom helped, and were therefore able to accomplish this well before flood season without hiring day labourers to complete the job.

nonetheless try to plant them. This could be considered a mixture of coping and adaptation, in the sense that it is not only a short-term activity aimed at an immediate threat, but also one intended to improve the household's capacity to deal with floods over several years. Given the current lack of trees in Bariakari, respondents there catch banana plants that have eroded and are floating in the river, using these to construct their boats.

- Beds are raised above the floodwater level, usually by men, who tie them to bamboo pillar supports with rope when floodwater begins to enter into homes. Bricks are also sometimes used to raise beds.

In terms of thresholds of coping, raising beds above the floodwater level is usually the first line of defence once flooding begins. Only when homes start to become completely submerged do respondents move to raised places elsewhere, like roads, embankments, or flood shelters. The top priority is to remain in one's own home for as long as possible, and respondents report even staying on the roofs before rising floodwater finally forces them to move. This is because they are unable to bring some of their most valuable possessions when they move—including the materials from which their houses are constructed. These and other resources are essentially lost, either being washed away or stolen. Some respondents also report lack of food, overcrowding, and unsanitary conditions in flood shelters, since people and animals all stay under the same crowded roof.

A second set of coping strategies undertaken once flooding begins concern the effects of loss of work and income. These tend to be differentiated according to the principal livelihood activities, and again, the main division lies between agriculture and river-based work, since the former becomes less available during flooding, whereas river-based activities are still available during flood season. While agriculture-dependent respondent households save money and store food, it is never sufficient in itself to cope with lack of work throughout the entire flood season. Therefore, most households also borrow from local moneylenders to buy food and other necessities during the flood season. A similar strategy, often undertaken by women, includes borrowing food from local shops on credit,[72] which is described in Box 19 below.

[72] This coping activity has also been highlighted in others studies on coping with floods in Bangladesh (e.g. Brouwer et al., 2007).

Box 19: Women get credit from local shopkeepers more easily than men

Apon (migrator, Rajiapur): "When I am not in house my wife goes to the store and if she asks 5kg rice and tell the shopkeeper that when my husband will come back he will pay for it. Then the shopkeeper gives her the rice and when I come back I pay. Woman have more power than man in this. They would not give to me. The women stay in house so the shopkeeper gives her, he knows where she is, but I do not stay in house so the shopkeeper does not give me."

Borrowing is more widespread when the pattern of flooding renders ineffective certain pre-flood preparation activities, for instance when flooding begins unexpectedly early and therefore does not leave enough time for migrating before the flood season, or when floods last longer than anticipated. Some respondent households dependent on agriculture rely disproportionately on borrowing during the flood season because they lack male members able to migrate (e.g. female-headed households or those in which male household members are physically incapable of migrating).

Respondents report that interest charged by moneylenders is high (10–20 per cent) and therefore, in terms of thresholds of coping, this is not a first choice option for most extremely poor households. Many respondents prefer to sell possessions that are not critical to their livelihoods. When this is not possible, some unload more critical livelihood resources, usually livestock, e.g. chickens or ducks, or goats/sheep to the extent that they own them. Other respondents, however, report that this is always a last resort option, and that borrowing money on interest is preferred to selling income-generating resources.

Box 20: Megh on coping sequence

Megh is an agricultural day labourer in Rajiapur. Three years ago she sold decorative plates and jewellery she had received as wedding gifts in order to repair her house, which had collapsed in a cyclone. While these were of great sentimental value she sold these instead of the goats she had been able to acquire through sharecattling. She received 400 *taka* for the jewellery and plates, but her family was still several hundred *taka* short. She explained that after borrowing small amounts of money from family and neighbours, she and her husband decided to borrow money on interest instead of selling the goats. They wanted to avoid selling the goats at least until they produced offspring, so they borrowed money from a local moneylender to repair their house. In the end, they had too much trouble repaying the loan because of low daily wages, and were forced to sell the goats in order to repay the money they had taken on interest.

Many respondents described similar priorities, borrowing from moneylenders before the last resort of selling off valuable livelihood possessions. For those involved in NGO programmes, these are usually cows acquired as asset transfers. Of course a majority of respondents, being extremely poor, own none or very few valuable livelihood resources. For the most part, either borrowing money or selling resources falls short of covering the costs of coping with the effects of flooding and dealing with other non-climate stresses, and they therefore do both, as in the case of Megh (Box 20), Brouwer and colleagues (2007) also found this to be the case in a study of coping among flood plain inhabitants in Bangladesh.

There is, however, a category of respondents for whom borrowing money is just not possible, i.e. older, non-working widows (the 'poorest of the poor'). Because of the high probability of default on repayments, moneylenders tend not to lend to these individuals, for whom begging becomes the only option. Respondents who have completely lost the ability to work engage in begging as a permanent livelihood activity. For others, begging is seen as part of the range of seasonal coping strategies, undertaken most often to address food insecurity resulting from *monga* and/or temporary loss of work due to seasonal weather patterns.

Finally, another widespread activity undertaken by agriculture-dependent households during flooding is to engage in diversification of income sources (Wisner et al., 2003; Agrawal, 2010), the most common being to fish locally. This is common to all respondents who are physically able to work.

Those households regularly involved in river-based livelihood activities, on the other hand, are able to work during floods, with boatmen actually earning higher incomes than at any other time of the year. For fishermen, incomes are lower during flood season, but they still generally earn something on a daily basis. For these two groups, coping during floods is more about protecting one's home and household resources (described above), and relatively more resources are dedicated to coping during other seasons when these livelihood activities become less lucrative.

Local government and NGOs provide assistance to respondents during the flood season that is deemed by many as critical for survival (Zaman 1999, cited in Brouwer et al., 2007). These include transport, emergency food, and healthcare. For respondents living in Bariakari, it is most often local government or NGO boats that move them and their possessions to the nearest flood shelter. Government and NGOs also distribute flood relief, however this is usually only during severe floods, rather than the regular, annual flooding. Government officials, usually including the chairman, visit flood-affected villages to survey the damage, returning a few days later to distribute sacks of rice. When flooding is prolonged, this distribution often occurs more

than once. According to most respondents in both field sites, most affected households receive something (usually between 2 and 5kg of rice), however challenges government officials face in distributing flood relief can create barriers to access for respondents, as described below:

Box 21: Challenges of accessing flood relief

> Kajomi (agricultural day labourer, Rajiapur): "I get less quantity of flood relief, but who are living in the embankment they get the most. When relief comes, the people blocked the distributor and they don't reach all the way here by the river. So we get less."

This illustrates a certain vicious cycle: extremely poor respondents are poor in part due to lack of access to emergency benefits, and this is exacerbated due to their location (i.e. directly on the river bank) (Brouwer et al., 2007). Furthermore, those who are willing and able to pay bribes receive much larger amounts of relief. In terms of information for coping with floods, however, some respondents report that government broadcasted information can be useful. For example some reported binding a piece of clean cloth to the mouth of tube wells during flood season as a measure for filtering water and reducing health impacts from flooding; this was learned from media broadcasts about coping with floods.

NGOs also distribute relief in both field sites, and usually in the form of packages that include food (e.g. rice and pulse) as well as other goods (e.g. matches, oil for kerosene lamps, soap). Free and accessible NGO healthcare is another major coping resource in both field sites, albeit only happens in some years. Anika, a beggar in Rajiapur, recalls that the 2005 flood season was particularly harsh for the community in terms of health—not because the floods were severe or prolonged, (in fact they experienced only normal flooding) but due to the floodwater being highly contaminated that year, which led to widespread outbreaks of cholera and diarrhoea that acutely affected young children and the elderly. Medicine distributed by an NGO-run floating hospital servicing the local area was, according to Anika and other respondents recalling the same episode, "…a miracle. Without it more people would have died." Floating hospitals do not operate only during the flood season, but since climate is one main source of sickness and injury for respondents, these become particularly important resources for coping during times of climate-related stress.

7.2.1.3. Post-flood recovery and coping

Most respondents suffer at least some setbacks during the flood season. Even boatmen, who earn their highest incomes at this time of year, still need to recover from the effects of flood damage to their homes. All respondents report working as much as possible to earn money for

these repairs as soon as flood season ends. Similar to the division of responsibilities characterizing pre-flood preparation measures, women and girls usually take responsibility for repairing damages to the floor and mud foundation of the house, while men undertake the more physically strenuous tasks of repairing and sometimes replacing bamboo pillar supports, and damage to roofs. Cleaning is a formidable task following flood season, since the floor and walls are covered in residue from contaminated floodwater. This is done by women and girls, who also sprinkle clean, dried dirt collected from raised, unpaved roads, over the floor of their homes to soak up the last remains of the floodwater, before smoothing and repairing the mud foundation of the house.

7.2.1.4. Changes in coping with floods

Very few respondents report changes in the flood coping measures described above. Most autonomous flood coping strategies have been employed for generations, and a majority of respondents report no change. A small minority reported changes in the frequency with which these activities are being undertaken, and in the amount of time and resources required for successful coping. For example, longer and more frequent floods have necessitated the building of more mobile stoves, collection of greater amounts of fuel wood and food prior to floods, and borrowing of larger sums from moneylenders during flood season. They also report increasing use of costly, last resort coping strategies (e.g. selling income-generating resources and moving from one's home to raised areas when homes become submerged).

Given that many respondents perceive changes in the flood pattern over recent years that have serious impacts on livelihoods (Chapter 6, Section 6.5.1.1), it seems contradictory that very few respondents report changing their flood coping behaviours according to perceived changes. This disconnect highlights a couple of important points. First, climate-related hazards are one of many sources of risk and vulnerability, and more respondents in both field sites report that, in the aggregate, non climate-related hazards pose greater challenges to their livelihoods than do individual climate-related shocks and stresses. This means that, while many respondents report adverse livelihood impacts from perceived changes in the flood pattern, there may be other, more pressing sources of risk and vulnerability, therefore few respondents dedicate scarce resources only to coping with these changes. This highlights the importance of placing climate-related hazards within the wider vulnerability context in order to make explicit the trade-offs extremely poor individuals face in coping with multiple sources of risk and vulnerability over different time scales (Eriksen and O'Brien, 2007; Brown, 2011; Eriksen and Brown, 2011; Kasperson and Kasperson, 1996).

On the other hand, a significant proportion (9 per cent of responses in Rajiapur, and 15 per cent

in Bariakari) (Chapter 6, Section 6.2.1) rank flooding to be the worst overall hazard to local livelihoods, suggesting that there should be a greater number of respondents engaging in changes in the coping behaviours. This disconnect highlights the importance of exploring limits to adaptation (Adger et al., 2009; Adger et al., 2007) that may exist, as well as the role of perceptions of risk (Marhsall et al., 2010) in terms of understanding the links between adaptive capacity and action (Burch and Robinson, 2007)—or perhaps more accurately in the case of the respondents in this research, between (in)capacity and (in)action.

Although there has been little change in autonomous coping, availability of intervention-based resources for coping with floods has increased in recent years. Respondents report a dramatic increase in the number of local flood shelters over the last 10–15 years, many of which have been constructed by NGOs. While no flood shelter currently exists in Rajiapur, the nearest one is in the neighbouring village, 2km away; in Bariakari, as previously mentioned, a flood shelter-cum-school was constructed near the end of the fieldwork period. In terms of ease of access to nearby shelters, it is interesting to note, however, that prior to construction of a flood shelter in Bariakari, community members living there still had an easier time accessing flood shelters on the mainland or on nearby *chars* than community members in Rajiapur do accessing the flood shelter 2km away. The latter report difficulty in reaching the flood shelter because roads become unusable during floods, and according to respondents, neither NGOs nor the local government provide this kind of transport assistance, leaving them with no option but to take shelter on raised roads and embankments, or to find (and pay for) their own transport to nearby flood shelters.

7.2.2. Coping with storms outside of flooding season

Heavy rainfall and storms (*dabar*) traditionally occur during the flood season, starting around the beginning of April and occurring through July/August. Coping with storms involves many of the same activities undertaken to cope with floods, and are covered in the preceding section. Storms that are less frequent or predictable, but more destructive (i.e. cyclones, locally known as *tufan* or *ghurnijhar*), occur at other times of the year. As with other climate-related shocks and stresses, coping with the effects of storms outside the flood season corresponds to two broad categories of activity—those undertaken to (1) physically protect homes and household resources, on the one hand, and (2) either maintain income/working opportunities or offset their loss.

7.2.2.1. Pre-storm preparation

Severe storms that occur outside the flood season cannot be predicted long in advance, although some respondents reportedly obtain short-term information through cyclone warnings from TV, radio, and newspapers. It is generally men who receive this information in the markets, usually sharing it with their families and neighbours upon returning home.

The only (common) preparation measure respondents take is to place large, heavy rocks on roofs of houses to prevent pieces of tin from flying off during cyclones. However, this strategy is only effective for homes not caught in the eye of the storm; these homes are usually ripped up and fly away, and no amount of preparation can prevent this, as houses are constructed from materials like bamboo and jutestick, rather than more durable materials like concrete. For this reason, many respondents insist the only real preparation for severe storms or cyclones is to 'pray to *Allah*':

Box 22: Praying to *Allah* as a coping strategy

> Ashik (beggar, Rajiapur): "What can I do? If we see that there is a possibility to come *hurka* [heavy wind] my house has not good pillar, then I make a pillar for my house by bamboo and we depend on *Allah*. That what *Allah* wants, *Allah* can do. If *Allah* wants *Allah* can save us. If *Allah* wants to kill us, *Allah* can do it. All we can do is pray."

7.2.2.2. Coping during storms

When storms are severe, respondents rely on social support networks (Wisner et al., 2003) and take shelter in more durable buildings, like in the houses of neighbours, usually non-poor community members whose houses are constructed out of more durable materials like concrete. Buildings like schools, local mosques and temples are also used for shelter. However, respondents in Bariakari are unable to use this strategy, since there are no structures built from sturdy, storm-resistant materials on the entire *char*. All houses on Bariakari, even those of middle class and rich community members, are constructed from tin, bamboo, and jutestick. This is reflected in the larger share of the Bariakari respondent community reporting that storms are the worst overall hazard they face (15 per cent), as opposed to 2 per cent of the Rajiapur respondent group (Chapter 6, Section 6.2.5). This illustrates another potential barrier to coping that is specific to the Bariakari respondent group—lack of access to shelter and safety in the case of storms.

In terms of livelihood activities, agricultural day labourers and river-based workers alike tend to miss work during strong storms and heavy rainfall—due either to dangerous conditions on the river or in the fields, wind damage to crops and fields, or waterlogging from prolonged rainfall. Work is usually missed for only a few days at a time, but for respondents who depend on daily income, borrowing money to purchase food is the most widespread coping response. For this kind of shorter term borrowing of smaller amounts (as opposed to that which lasts throughout all of flood season), *dhar koroj* between neighbours and community members is common, including the give and take of small amounts of both money and food.

7.2.2.3. Post-storm coping

The main differentiation in post-storm coping is locational—those households in the eye of the storm, whose homes were destroyed, face major challenges; for most, the effects include partial, rather than total, damages. For these households, post-storm coping is similar to post-flood coping—women and girls repair any damages or cracks in the mud foundation of houses, which tend to occur where walls meet the floor due to shaking of bamboo pillars during storms. Men repair any damages to the walls and the roof. Respondents commonly sell resources, and/or borrow money, usually from local moneylenders or local NGOs, to pay for repairs, especially when houses are completely destroyed or fall down entirely, which happens often during severe storms. It is also common for respondents to suffer from fevers and colds following storms, therefore often another post-storm coping activity is purchasing and taking medicine for those who became ill.

7.2.2.4. Changes in coping with storms

Not a single respondent reports changes in coping with storms. This may be related to the fact that there are very few activities that can be undertaken in the first place. For respondents in both field sites, financial barriers (Brouwer et al., 2007; Adger et al., 2009) may be too great to overcome in relation to coping with storms, since generally respondents are unable to afford more durable home construction materials. Respondents in Rajiapur can and do take shelter in more durable buildings in the vicinity; however this is not an option for those in Bariakari, since travel to the mainland to access more durable structures is extremely dangerous during storms.

People's perceptions may also explain the lack of change in behaviour. There seems to be a certain degree of consensus among respondents that flood patterns are changing, but opinions about changes in storms are considerably more divergent, and such mixed perceptions about the need to adjust behaviours may contribute to lack of action. That said, given the lack of financial resources and physical access to solid structures, the main response in both field sites to storms

is “bearing losses” (Burton, 1996; Burton et al., 1998), although for extremely poor individuals, such as the respondents in this research, there is little element of ‘choice’ in this situation.

7.2.3. Coping with erosion

Riverbank erosion usually affects all respondent households near the river’s edge in broadly similar ways. Regardless of the main livelihood activity, respondents must stop working in order to gather and move their belongings, and to find a new place to live. There is some gender-based differentiation in responsibilities for coping with erosion within the household.

7.2.3.1. Pre-erosion preparation

Respondents engage in few, if any, preparatory measures to manage the risk of riverbank erosion. It is difficult to predict when erosion will occur, and the majority cannot afford to purchase even small plots of land. While erosion has historically occurred mainly during the flood season—since stronger currents during flooding induce erosion of soft riverbank soils—it is reportedly now also occurring outside flood season (Chapter 6, Section 6.5.1.1). Both field sites are in areas that are generally erosion-prone throughout the year, and as a consequence of their extreme poverty, respondents tend to inhabit the most erosion-prone parts of these already ecologically fragile areas—with their homes often located on low-lying land directly next to the river.

For the respondents whose households are set back slightly from the riverbank, preparation is sometimes possible, when they observe erosion occurring directly at the riverbank. They often begin to pack up belongings, and female household members build mobile stoves so they can cook while looking for new homestead land after erosion reaches them. In some cases, families prepare by searching for new land elsewhere, but this requires resources and therefore is done mainly by better-off households or those with family members or friends (i.e. social support networks, Wisner et al., 2003) who can negotiate deals on new homestead plots on their behalf.

7.2.3.2. Coping during and after erosion

“Mobility” (Agrawal, 2010), or “changing locations” (Burton, 1996; Burton et al., 1998) is the main response to erosion. Once it begins, community members whose homes are in areas that are not affected, often come to the aide of those who are, helping them gather and salvage their belongings as quickly as possible. If moving to another piece of land in the same area, some individuals (usually men and boys) do the physical moving, and others (usually women) stay back to guard belongings so they are not stolen. Many respondents move between *chars*, or

from *chars* to embankment areas and vice versa, in which case a boat needs to be hired for the day to move belongings.

When entire neighbourhoods are affected by erosion, relocating becomes a collective process, with households coming together to decide where and when to move. This is more common in *char* areas, where groups of households are usually able to find land together on another *char*, whereas households in embankment areas have most often done so in a more dispersed way, as individual families, given how overcrowded the area is. This difference is reflected in the pattern of occupation in Bariakari since it began to re-emerge, about 12 years ago. This pattern has been, in large part, determined by the pattern of erosion on Vati Kamari, a neighbouring *char* that has been badly affected by erosion and severe flooding over the last two years, during which time groups of families, and often entire segments of communities, have been moving to Bariakari collectively, in swathes as their homestead land in Vati Kamari eroded or was completely destroyed by floods.

Collective relocation as a strategy for coping with erosion among *char* communities has been documented in other studies, and is a means of retaining the unofficial safety nets (e.g. *dhar koroj*) that operate at community level (see Hutton and Haque, 2004; Hossain, 1984; Uddin and Basak, 2012). This was also found to be the case among the Bariakari respondents in this research. Furthermore, while Bariakari respondents have faced erosion, on average, far more times in their lives than have their Rajiapur counterparts, few had ever made the decision to move to the mainland rather than between *chars*. This may have something to do with the greater ease not only of finding new plots of land *per se*, but also of finding enough land to accommodate entire groups of households, thus maintaining a certain level of community cohesion and the unofficial networks on which they depend. This is reflected in data from household interviews—the only respondents that report breakdown of community cohesion as an outcome of erosion are from Rajiapur:

Box 23: Breakdown of community cohesion from erosion

Shimu (agricultural day labourer, Rajiapur): "When I move I won't have a good relation with these people anymore. I will have to create new relations with those people where I move to."

Chumke (non-working child, Rajiapur): "When riverbank erosion happens, we need to move our house to a safe place, but people start to fight with us in the new place, so it is bad. When we move to new places and we go outside, then the people say bad things to us, but here nobody would tell us these things because everybody here knows us very well. We have a good relation here."

Jamila (maidservant/beggar, Rajiapur): "So many people lived in this village before. Some already moved due to erosion, some are moving now. If we all lived together in one place then if I need food I can ask my neighbour for food."

Experiences of coping with erosion among respondents in Rajiapur tend to be more variable than for respondents in Bariakari, since it involves moving to any number of places, wherever land is available. While there are differences between the two field sites, decisions about relocation for respondents in both tend to be influenced by family and community networks. In some cases, family or community contacts are able to negotiate stalled rental payments on new patches of land for those displaced by erosion, however this was uncommon among extremely poor community members.

Most respondents report moving to any land they can find after being displaced, usually poor quality, low-lying land by the river that is available only because nobody else wants it. Others report that acquiring new homestead land involves conflict:

Box 24: The search for new land after erosion in Rajiapur

Akash (fisherman, Rajiapur): "We don't own homestead land, this is something we need. Facing erosion doesn't depend on what we want, just on what we can manage—if we are lucky and get good land we take it, if we get low land, we take it. We have to take whatever land we can."

Rifat Ara (agricultural day labourer, Rajiapur): "After erosion we stand beside the road and we seek land from others. If anybody gives us land then we make our house there. At first nobody wants to give land. Sometimes we make fight with them and then they give a little bit of land to stay. Sometimes the people think 'where they will stay with their children? They can't stay on the road.' So, they become kind and give us a little bit of land to stay for some days."

While these stories are more common among individual field respondents in Rajiapur, this is not to suggest that erosion-induced relocation is easier to cope with in Bariakari, or in *char* areas generally, only that in Bariakari the process seems to be more collective than in Rajiapur. While the maintenance of well-functioning unofficial community safety nets and the greater relative availability of land may underpin erosion coping choices for *char* communities more than among mainland respondents, it also means that these communities have an incentive to remain living in the *chars,* which ultimately means they are confined to a cycle whereby as often as every couple of years, livelihood resources are eroded, making it very difficult to surpass a very low level of resource ownership and ultimately escape poverty (Haque, 1997, cited in Hutton and Haque, 2004; Uddin and Basak, 2012).

Finally, as seen in the story about Masud and his family, borrowing money from family and community members as a first response, and from local moneylenders if necessary, is the other coping strategy reported by nearly every erosion-affected respondent. This is common across all livelihood groups in both field sites, since, regardless of the work a respondent is engaged in or where, if erosion begins, work is forgone in order to relocate, therefore money is borrowed to replace daily income until normal life and work can be resumed.

7.2.3.3. Changes in coping with erosion

Erosion-coping activities *per se* have not changed in recent years; however, certain wider patterns of change in the local area are affecting the options for extremely poor respondents. The main trend they identified is the decreasing availability, and therefore increasing cost, of land. This is especially problematic in mainland areas, which are becoming more overcrowded, a result of increasing rates of erosion, compounded by population growth. Respondents in both field sites face ever more serious challenges in finding new homestead land after erosion and are very often forced to inhabit poor quality, marginal lands that are at high biophysical risk from flooding and erosion. The inability to acquire better quality land in less risk-prone areas effectively traps extremely poor households in a cycle of permanent (sometimes increasing) climate vulnerability. As mentioned above, the possibility of re-claiming land that has eroded may actually create an incentive for respondents to stay living in erosion-prone areas.

7.2.4. Coping with drought

Strategies used to cope with drought include both (1) activities undertaken to manage the shortage of water for household use (storage) (Wisner et al., 2003); and (2) those employed to manage effects on livelihood activities, including shortage of water for crops and animals for agriculturalists, or decreasing water levels in the river for households dependent on river-based

livelihoods (e.g. diversification, migration) (Agrawal, 2010; Wisner et al., 2003; Burton, 1996; Burton et al., 1998). The push in the last few years by the government and various NGOs to introduce higher yielding drought-resistant maize varieties in parts of Rangpur, and the fact that a number of respondents are participating, could be considered not only a coping, but also an adaptation response, although none of the respondents volunteered that information or characterised their planting of maize as a drought-response activity.

As with flooding, drought-coping strategies in the first category above are common across all respondent households, while those in the second category vary depending on the livelihood activities in which respondents are engaged when drought occurs. The main differentiation in relation to coping that corresponds to the second category is between measures used by sharecroppers, farmers, and agricultural day labourers, on the one hand, and those used by fishermen and boatmen, on the other. Differentiation in coping undertaken to address shortage of water for household use (the first category), is at the intra-household level, i.e. in the tasks carried out by men and women within the household.

7.2.4.1. Pre-drought coping

According to respondents across the board, groundwater levels dry up in March and April, reducing the availability of drinking water in tube wells. Respondents in both field sites prepare for this by collecting water from tube wells in early March, and storing it in vessels inside their homes (Wisner et al., 2003). This is done by women and girls, and is common to all respondents since all use tube wells as the primary source of drinking water. This water is then either consumed directly or used to replenish the water in tube wells as it begins to dry up. Stored water is also used to irrigate homestead vegetables during drought months.

7.2.4.2. Coping during drought

When tube well water becomes unavailable, stored water is used for drinking; however if this supply runs out, women either travel greater distances to find the nearest usable tube well, or collect water from the river. This water is only sometimes boiled before consumption; when not boiled, drinking or using it to clean utensils sometimes causes diarrhoea and other waterborne diseases. Water is also collected from the river or nearby ponds (in Rajiapur; there are only ponds in Bariakari in the rainy season) to irrigate homestead vegetable gardens. During severe heat and drought, respondents also use water stored in their homes, or collected from the river, to cool themselves, particularly children and the elderly who suffer disproportionately from extreme heat. Water from tube wells—when it has not dried completely—becomes very hot during these months.

Shade from the sun during hot, drought-prone months is critical for respondents and their livestock, but there are no trees or tall vegetation on Bariakari *char*. Therefore another strategy—which might be considered to have some elements of longer-term adaptation, inasmuch as it is not undertaken simply to cope with an immediate stress but rather to improve living conditions for the longer term—has been planting trees to increase shade, and for "more oxygen," according to Konika, a respondent living in Bariakari's South *para*. These strategies, especially storing water, are common across all respondent households, since they respond to needs that are common across all respondents—for drinking water and shade.

In terms of coping with the effects of drought on livelihood activities, there is some differentiation between river and agriculture-based livelihoods. For boatmen, extreme drought conditions can lead to significantly lower water levels in the river, which in turn, may decrease demand for their services. This is particularly true in the *char* field site, since for most of the year, parts of the *char* remain separated by small canals of water. These become much larger during flood season, but many of them dry up and disappear completely during the hot, drought-prone months. Some neighbouring *chars* can even be reached by foot during these times, and accordingly, the demand for local boat transportation declines dramatically. For fishermen, lower water levels can be beneficial, making it easier to catch fish; however, if water levels decrease too much, this group also finds itself with significantly reduced work opportunities. Therefore, as with agricultural day labourers during floods, it is common for those engaged in river-based work to diversify their income sources, usually by engaging in agricultural day labour or construction, or by changing location, i.e. migrating to other districts for work.

Agricultural day labour, however, is only available to the extent that drought is not severe enough to affect production in the local area. When this does occur, agricultural day labourers and river-based workers alike diversify, either locally or elsewhere. Some drought, however, can be beneficial, since increased need for irrigation provides additional jobs during drought-prone months. On the other hand, working conditions in agricultural fields during dry, hot months are harsh; for older respondents and those with health problems, such conditions are often too harsh to endure, and these individuals must work fewer hours per day, usually only during the morning and late evenings, resulting in lower daily incomes. For sharecropping respondents, the need for irrigation adds an additional expense to cultivation, which can be difficult to manage, particularly when crops are destroyed anyway if respondents are unable to afford to irrigate regularly enough.

7.2.4.3. Post drought recovery

There is relatively less post-recovery associated with the effects of drought than is the case with flooding or erosion, mainly because drought has very little impact on homes and household resources (e.g. furniture, utensils). Depending on the severity, post-drought recovery is focused on health impacts and, for those involved in farming, on dealing with loss of income and work opportunities.

7.2.4.4. Changes in coping with drought

Very few respondents report changes in the way their households cope with drought. One possible reason is that, while 97 per cent of those respondents who do perceive a change in drought patterns report that it has increased, only six per cent of responses rank drought as the worst climate-related hazard, and just one respondent reported it to be the worst overall hazard. Brouwer et al. (2007) also observed a relationship between perceptions of the relative importance of a hazard (in that case, flooding) and willingness/ability to change practices.

Those who do report changes say that they store water more frequently during March and April now than in the past, and greater amounts need to be stored since, while tube wells have always dried out during this period, the severity of the problem has increased over recent years, i.e. all or most tube wells in one area dry out at the same time, due to decreasing groundwater levels. In the past, these women collected water from a neighbour's tube well if the one they use had dried, as it was easier to find a nearby tube well that was unaffected. However, respondents report now having to travel greater distances to locate unaffected tube wells. Deep tube wells are not usually affected during these months, but few exist in either fieldwork site. Some respondents report that an increasingly widespread reliance on groundwater irrigation for cultivation, through use of shallow water machines during drought months, has exacerbated this problem in recent years. As noted above, the government and some NGOs have been encouraging planting of drought-resistant high-yielding maize varieties in recent years, and most respondents involved in agriculture on Bariakari are participating. Although more drought resistant, the crop does require some irrigation and therefore sustainability over time could become an issue.

The following three tables synthesize main findings elaborated in Section 7.2 regarding: (1) the prevalence of certain coping strategies and differentiation at the inter- and intra-household levels, and in some cases between the two field sites (Table 30); (2) common patterns in the sequence of resources that extreme poor and poorest of the poor households deploy in coping, and the likely impact on their household status after the shock (Table 31), and; (3) drawing on

the example of floods, examples of thresholds and limits on coping before, during, and after shocks (Table 32). A final word of caution is, however, important: while certain patterns can be identified with regard to coping strategies, limits, thresholds, and impacts, research findings also identified subtle variations that cannot all be captured in summary tables. While it may not be practical to identify and classify all such variations, it is important to remain mindful of their existence.

Table 30: Prevalence of types of coping strategies and differentiation in adoption

Hazard	Type of coping strategy*	Strategy examples	Prevalence	Differentiation	
				Intra-household	Inter-household
Storms	Impact minimizing	Home protection: 1. Reinforcing (bamboo pillars and walls) 2. Protecting foundation	Widespread	1. Men and boys 2. Women and girls	None (Same across all affected households able to afford materials)
Flood	Impact minimizing	Raised housing	Limited	None	Mainly households involved in NGO programmes
Flood and drought	Diversifying income sources	Seasonal fishing, seasonal agricultural day labour, begging	Widespread	None, men and women engage, and all age groups excluding young children	Between river- and farm-dependent households
Flood and drought	Change location	Migration	Widespread	Only men	All livelihood groups, but at different times in the year
Drought	Building up stores	Storing water	Widespread	Women and girls	All affected households
Drought	Modify the threat	Planting banana trees	Limited	None	Only in Bariakari
Erosion	Social support networks Change location	Collective relocation	Widespread	None	Mainly in Bariakari
Storms	Impact minimizing	Take shelter in solid structures	Widespread	None	Only in Rajiapur

(*After Burton, 1996; Burton et al., 1998; Wisner et al., 2003).

Table 31: Common sequence of resources used in coping strategies and likely impacts

HH poverty category pre-shock	Resources used in coping with shock	HH status after shock
1. Extreme poor HHs	**1a.** HH able to use only own resources and/or obtain some help from family, neighbours, NGOs or government relief programmes for coping ➔➔	**1a.** HH emerges with minor losses; similar level of poverty
	1b. HH also has to sell some non-income generating resources (e.g. utensils); borrow from moneylenders or others ➔➔	**1b.** HH emerges with greater, but still reversible, losses; recovers similar level of poverty soon
	1c/1d. In addition to above, HH forced to sell income-generating resources (e.g. livestock)	**1c.** HH losses are reversible with difficulty; HH recovers similar level of poverty after a few years **1d.** Losses are irreversible, and HH falls deeper into poverty; some may become poorest of the poor
2. Poorest of the poor HHs (beggars, widows)	**2.** HH has no means to protect homes (if any); seeks help of family or neighbours, or moves directly to shelters. Little or no resources and unable to borrow; completely dependent on others for survival. ➔➔	**2.** HH remains among poorest of the poor, possibly worse if health affected or if situation of family/neighbours who had previously provided help has worsened.

Table 32: Thresholds and limits for coping: example of floods

Pre-event coping	Threshold	During event coping	Post-event coping
Preventative measures to **protect home and HH resources** (e.g. build moveable stoves, reinforce bamboo pillars) Limits: Liquid resources to procure materials	Water level: if too high → move to raised road or flood shelter Limits: Access to NGO/gov't boats; ability to construct makeshift boat out of banana leaves	Raise beds above floodwater level Limits: Presence of able-bodied male to raise bed	Clean house, make necessary repairs Limits: Ability to afford materials
---	---	---	---
Prepare for **loss of work/income** (e.g. save money, store food, migrate) Limits: financial (daily income too low to save money/purchase food for storage); social networks (not strong enough to depend on *dhar koroj*); presence of male able to migrate Raising homestead land (NGO) Limits: Land tenure; design of programme (income offered for work and timing to occur well before flooding begins); security (enough HHs must be raised)	Pre-flood daily income: if insufficient to store enough food → sell off non-income generating livelihood resources Limits: the extent to which respondents own non-income generating resources Selling non income generating resources insufficient → borrow money from local moneylenders Limits: poverty level – poorest of the poor unable to borrow Borrowing insufficient or unable to borrow → sell off income generating resources Limits: extent to which respondents own income generating resources	Depend on stored resources Limits: financial (daily income too low to store sufficient resources) Diversify income sources (e.g. seasonal fishing) NGO/Gov't flood relief Limits: Severity of flood – relief only distributed in severe floods, not normal floods; access to poorest of the poor on riverbank; corruption Flood shelters	Work as much as possible to repay borrowed money; those unable to work beg Limits: Physical capability following floods, availability of local work and/or ability to migrate Food for work programmes Limits: availability in local area; physical capacity to engage in strenuous work

7.3. Mediating factors

The term ‘mediating factors’ refers to the factors and processes that influence the level and nature of coping/adaptive response by different individuals and households. The main mediating factors observed in the course of fieldwork are presented below, these include: physical health and capability; community and family networks; political ties and corruption; information about climate and weather; and awareness about climate change, perceptions, and beliefs about the causes. These factors both shape access to the resources necessary for building secure livelihoods (e.g. financial resources, land, etc.), and influence local beliefs and mind sets, that in turn affect ability and willingness to respond to climate-related impacts (i.e. the ‘motivational context’, (Haddad, 2005)). Mediating factors can act as barriers to coping and adaptation in some cases, and in other cases present opportunities for respondents, thus comprising factors that influence both vulnerability, on the one hand, and potential determinants of adaptive capacity, on the other.

The Mediating Factors Framework used here borrows elements from conceptual models that deal both with vulnerability (Adger, 1999; Kelly and Adger, 2000; Chambers, 2006; Allen, 2003; Blaikie et al., 1994; Wisner et al., 2003) and determinants of adaptive capacity (Smit and Wandel, 2006; Adger et al., 2007; Ensor, 2011; Levine et al., 2011; Marshall et al., 2010; CCCD, 2009), as a way to broaden focus to include all relevant factors and processes that may condition coping and adaptation (or potential for it) among respondents. The mediating factors discussed below operate at the individual, household, and community levels, and function both in normal times, during which they are instrumental in how respondents organize their livelihoods, as well as during times of coping with shocks and stresses, climate-related or otherwise.

7.3.1. Health and physical capability

Poor health (including sickness, injury, and disability) was found to be a major driver of vulnerability among respondents, with 17 per cent of responses about the relative importance of different hazards identifying health-related shocks to be the most serious of all. Conversely, health and “able-bodiedness” (Chambers, 1989: 4)—the ability to “use labour power effectively” (Wisner et al., 2003: 113) was cited by a large share of respondents as the single most important livelihood resource, given reliance on labour for income. In view of the low daily wages, the more respondents are able to work and save even small amounts of money, the consistently better positioned they are to cope with climate (and non climate-related) shocks as and when they arise, than are those who are unable to work. This is reflected in the fact that health and access to healthcare are often included as indicators in

adaptive capacity frameworks (sometimes subsumed within 'human capital and resources') (CCCD 2009; Jones et al., 2010; Levine et al., 2011; Adger et al., 2007; Marshall et al., 2010).

The links between physical capability/health and climate were found to operate in two broad, mutually reinforcing ways in this research: respondent households, and poor individuals in general, usually start out from a baseline of poorer health than do the non-poor, and they are therefore more vulnerable to the health impacts from climate (and non climate-related) shocks and stresses. This is a result of various limitations, including malnourishment, living in poor-quality and exposed housing, in areas that are at great biophysical risk, for example on riverbanks or *char* islands, and dependence on work that is physically demanding. Extremely poor individuals also tend to lack money to invest in proper medical treatment and medicine when they do fall ill, and are often unable to forgo working when they are affected by minor health problems, such as fever and colds, which, in turn, often develop into more serious conditions (Sen, 2003; Krishna, 2010). Conversely, poor health and injury are often outcomes of climate-related shocks and stresses.

At the individual level, respondents whose health problems (disabilities, injuries, or chronic health conditions) interfere with their ability to work and earn money tend to be in the worst position with respect to coping with climate-related hazards. Some are elderly individuals who are no longer able to undertake physically strenuous work. Some may rely on family for food and money while others do not have such family networks; either way, most of these individuals supplement the work they are able to do, or support they do receive, with begging. Of these respondents, Sadia is completely physically disabled; she cannot walk and therefore depends entirely on family members. She is particularly vulnerable to the effects of flooding, since she must rely on her son's family to move her out of the floodwater.

Box 25: Physical disability and dependence on family

> Sadia (non-working respondent, Rajiapur): "I have a broken backbone, I cannot move and have headaches and pain in the whole body. *Bogoban* [God for Hindus] has made me disabled now so I can't work. I don't move without help. I depend on my son, if is working, then I can eat, if he can't manage sometimes I don't eat… in floods, my son and grandson raise my bed and put me there. I stay and my daughter-in-law bring food, water… Sometimes I call for them and they are not there. I just wait, what more can I do?"

Other respondents are able to work, but chronic poor health reduces how much they can do, and therefore their daily wages. For instance, many respondents report suffering from high

blood pressure, for which they cannot afford to take medication on a regular basis. They have a particularly difficult time during periods of extreme heat and as a result have fewer financial savings to fall back on for coping with shocks and stresses (climate-related or otherwise).

At the household level, those with members who are chronically ill or disabled are generally worse off: having limited resources tied up in paying for medical treatments leaves fewer resources available for coping with climate-related hazards and other shocks. This includes financial and other resources critical for re-establishing livelihoods after shocks, such as livestock (to the extent that extremely poor respondents own livestock), as animals are often sold in order to afford medical treatment for sick household members. Households with members who are beneficiaries of local NGO/development programmes often resort to unloading livelihood asset transfers (again, most often livestock) to pay for treatment and medication when a household member falls ill. Hasan and Nilufer, the son and daughter-in-law of Sadia, introduced above, rely on fishing as their main source of income; however, Sadia's disability and chronic pain have led them ultimately to sell their boat, one of their most important livelihood resources.

Box 26: Selling critical livelihood resources to cope with health shocks

> Hasan (fisherman, Rajiapur): "We have *dena* [a loan from a moneylender that is yet to be repaid], so I will sell the boat and repay my *dena*. My mother was sick, for her treatment I took loan, and I was also sick. I was affected by diarrhoea, so took medicine. So we took *dena*. The people from whom we took the *dena*, they are keeping pressure on me to repay. So we will sell the boat and repay the *dena*."
>
> A few months after this, during flood season, Nilufer, Hasan's wife, shared the following:
>
> Nilufer (non-working respondent, Rajiapur): "Now he [Hasan] works on Akash's [a local fisherman] boat. Now it is flood time and there is less fish in the river. The income is lower and he shares the money between them and Akash's son… Now we must take *dena* to eat. We have spent the money from the boat for treatment for Sadia and we have little income, we must take more *dena* to survive the flood."

These findings are consistent with research by others on the role that health crises play as drivers of downward mobility, particularly for families near or below the poverty line (Sen, 2003; Krishna, 2010; Pryer, 1989).

Evidence from some household interviews suggests that climate—and in particular, perceived changes in seasonal weather patterns—lead to increased incidence of common health problems, such as colds, fever, and diarrhoea, resulting from unexpected weather conditions

(e.g. cold spells during traditionally warm months, drought conditions during historically rainy periods). To the extent that accelerating climate change does increase the prevalence of both serious and minor health risks and injuries, this may imply both increasing expenditures on medicine and treatment, as well as increasing loss of work due to injury and poor health. This may make health an even greater driver of vulnerability than it already is for extremely poor households.

Another dimension of physical capability that emerged as a factor mediating access to resources in some cases is physical strength. This came up mainly in relation to being able to enforce rights to land:

Box 27: The role of physical strength in enforcing rights to land use

Mamun (agricultural day labourer, Bariakari): "It's my fathers land. I was in Rangpur when my father died, at that time he divided the land for us. We were six brothers, three of them are died and after dividing the land of my father's I get two *bigha* land. We are three brothers alive… Actually my nephew, son of one brother, he use the land and I am not able to use the land at all. From last four years I fight with my brothers and nephew about this land. I also make case in court but even the problem is not solved. I don't get the title of the land yet… When I came from Rangpur after death of my father, at that time my brother and their sons were using the land. But when I came from Rangpur I said that 'give me my land,' but they didn't give my land, they don't want to give. So the fight is start then… I try to cultivate anyhow but then they beat me. Because I am alone here they live with their family. They come more powerful and they don't want that I stay here at all. Last mid-March they come four father and their sons to beat me. I don't do any case against them after that… this year my eldest son was here for two months, he lives in Dhaka. My son and another nephew (son of the third brother, who also is trying to access land) and husband of my niece we all go to the land and said 'you are just using my land you don't give me any money for using this, no crops and we will cultivate on this land.' We start to use the land and my son help to protect and we used the land. My brother was so angry that he gives a rape case against me in the Union Parishad, but the chairman member dismiss this case because there was no witness… still I don't use the land now. My son is in Dhaka now and I don't manage alone to use the land".

Two of the widows in the respondent group had similar stories, whereby they had owned agricultural land when their husbands were alive, but after the death of their husbands, their in-laws forcibly removed them from the land. Both of these women are now beggars and identify the inability to defend their land, and lack of support from their in-laws, as a major driver of their poverty and vulnerability.

7.3.2. Community and family networks

Community and family networks are essential both to how respondents organize their livelihoods and access certain income-earning opportunities throughout the year, as well as how they cope with shocks and stresses, climate-related or otherwise. In relation to the former, two respondents, one in Bariakari and one in Rajiapur, engage primarily in income-earning activities that do not depend on either the river or agriculture, and both report availing themselves of these opportunities through relationships with fellow community members or family.

Box 28: Accessing income-earning opportunities through family and community networks

Dewan was previously an agricultural day labourer living in Bariakari. He was able to acquire a job in a sweater factory in Dhaka through a neighbour who works there; the job pays more than the local agricultural day labour he previously engaged in, so he currently migrates during most of the year, sending money home to his family. This is one of the few households reporting a decrease in poverty levels over the last few years, and household members identify remittances from Dewan's sweater factory job as one of the main reasons.

Mamun currently runs a shop out of his home, and started up the business with an interest-free loan given by his cousin, who is in a slightly better financial position and therefore agreed to a repayment schedule that is more flexible than that offered by local NGOs or moneylenders.

Both households, reportedly as a result of engaging in these activities, also identify themselves as better off than most other households in the respondent group (poor rather than extremely poor), and are characterized by a level of resource ownership that places them at the higher end of the range of extremely poor households as identified in participatory wealth rankings.

On the other hand, family relationships and networks do not always work in a respondent's favour, as in the case of Mamun, introduced above in Box 27, and for the widows who have been pushed off their land by the families of their husbands.

Unofficial safety nets operating at the community level comprise another element of community networks that emerge as critical in the lives of respondents. The *dhar koroj* system operates throughout the year, during which it is customary for respondents to rely primarily on neighbours and fellow community members for small, everyday items, like salt and chilli for cooking, paddy, or small sums of money (up to around 200 *taka*). Respondents report falling back on this system during times of hardship, for instance during lack of work due to illness, but this is usually based on relationships that were built over some time, and therefore exists primarily among those with some degree of familiarity. This underpins the

importance of building up social networks with other community members as a preventive coping strategy (Wisner et al., 2003); calling on friends and neighbours to help requires first building relationships with them.

However, there are limits to local community safety nets, mainly that they tend to operate less during periods of covariate shock, and also, some of the poorest of the poor among the respondent group (i.e. widows and beggars) report not being included in this system. In relation to the former, when households are all badly affected by the same event, for instance by severe flooding or erosion, they become less able to lend even small amounts of food or money to one another. However, some respondents rely on *dhar koroj* as a means of preparing before the flood season begins, for instance agricultural day labourers, who store food borrowed from neighbours as part of their flood preparation strategy (Section 7.2.1.1).

In relation to the poorest of the poor being excluded from *dhar koroj,* this is due to norms and expectations of reciprocity and rapid repayment. While interest is not charged on small amounts of money borrowed between neighbours, it is expected that the money will be re-paid quickly, usually within days. In relation to food, there is an expectation of repayment attached to lending certain kinds of food, e.g. uncooked rice; cooked food, on the other hand, is considered a gift.

Box 29: Dhar koroj and norms of reciprocity

> Zahir (agricultural day labourer, Bariakari): "For money we have to return after borrow. But for food sometimes you don't have to return. Suppose I don't have rice then I go to someone and ask that 'give me some rice to eat,' then they give. In that case it is OK if I don't give it back. But if you take paddy or *taka* then you have to give it back… if I ask anyone to give me 10 *taka hawlat* I must return it after two or three days. It is called '*dhar koroj*'.

However, there is an expectation of reciprocity at some point in the future generally attached to gifts of food. For these reasons, the respondent households classified as 'poorest of the poor' with no ability to reciprocate in the future are generally not included in these unofficial community safety nets.

Box 30: Poorest respondents don't engage in dhar

> Trina (beggar, Rajiapur): I want to take *hawlat* when I have no food. People don't give *hawlat* for long time, people want that you return quickly, and I can't do this. People don't want to give me *hawlat*… I have to repay *hawlat* according to the date, and I have no work so how can I repay? This is the thing.

While *dhar koroj* generally operates less during times of weather-induced hardship, such as during the flood season, a family safety net does seem to remain intact. Many respondents report receiving packages of food, clothing, and other goods during the flood season from family members living in other districts that are unaffected. This is more common during the flood season than at any other time of the year, and is usually relied upon during times when neighbours and fellow community members are unable to help one another through *dhar koroj*. This reflects literature on the nature of informal social and family networks as a potential element of adaptive capacity: "for a network to enhance resilience, different nodes of the network must rely on different resources, or the resource must be heterogeneous in space or time" (Marshall et al., 2010: 15). While community *dhar koroj* is relied upon primarily when respondents experience idiosyncratic shocks, family support networks seem to become essential for coping during times of covariate shock, with family members usually being located in other districts: areas that are unaffected by a given flood, drought, or other shock, and are therefore more able to provide assistance than fellow community members.

Those respondents who are least able to cope with climate-related shocks and stresses are those who lack such family networks. This is especially true of widows whose children are also extremely poor and have little or no ability to provide assistance. Some respondent widows, on the other hand, live with and are completely supported by their children's families, making it much easier to cope during times of hardship. These coincide with findings from other studies (e.g. Khan and Seeley, 2005; Gardner and Ahmed, 2009) on the role of family and community networks and relationships in coping with shocks in a Bangladesh village context.

From the household perspective, on the other hand, a large dependency ratio seems to negatively affect the ability to deal with shocks and stresses, both climate and non-climate related. In particular, those households with several young children, or with dependent older disabled or non-working individuals, were generally less able to engage in effective, successful coping. While, for older, non-working individuals, especially the disabled widow respondents, being part of a household in which others are working greatly improves their capacity to cope with climate-related shocks and stresses, overall those households seem to have lower capacity to cope and adapt than do households with lower dependency ratios. Comparing across beneficiary households with similar incomes and livelihood resources, those in the best position seemed to be those with working age but unmarried children, who do work and contribute to household income. Indeed, other than erosion, the most commonly stated reason for increasing poverty levels among respondents over the last 10 years was an increase in their household dependency ratio, and conversely, increasing numbers of people

working and contributing to household income was among the most commonly cited reasons for decreasing poverty.

Collective decision-making is another feature of family and community networks that is of central importance in coping with climate-related hazards. For instance, during the flood season, when water levels become too high for respondents to stay in their homes on raised beds, community members come together to discuss where and when to move, do so collectively, and usually help one another transport belongings. It is also common among respondents to stay in the raised houses of neighbours and other community members when their houses become uninhabitable. This is more common in the *char* field site, where there is a lack of raised roads and embankment areas to inhabit during severe flooding. In Rajiapur, on the other hand, it is more common for respondents to take shelter on raised local roads and the embankment during flooding, and in more durable buildings or houses of non-poor community members during storms.

Collective decision-making also underpins coping for respondents who are forced to relocate due to erosion, although this is more common in Bariakari (Section 7.2.3.2), and represents perhaps the only coherent coping response available to erosion-affected *char* communities more generally (Hutton and Haque, 2004).

Box 31: Collective, erosion-induced relocation in Bariakari

> Prianka (construction worker, Bariakari): "Say our *char* started to erode. Then we find another *char*, then talk with other villagers and tell them 'let's go there. All together we can live there.' Then we help each other to take down the houses, separate walls, and move them together."

The findings here relate to literature on the role of community-level determinants of adaptive capacity, such as the capacity to re-organize, or "effectively respond to disturbances in order to plan for disturbance" (Marshall et al., 2010: 16). While most of the erosion-induced relocation taking place among respondents is reactive, i.e. taking place after erosion begins, it does nonetheless provide evidence that groups of respondents have managed to carry out fairly major undertakings (e.g. re-establishing entire *paras* on new *chars*) in a coordinated way in response to climate-related shocks, with little external support. This suggests that the potential exists for forward-planning, successful autonomous adaptation among extremely poor communities.

On the other hand, while having experienced and coped with a hazard in the past does make an individual or community better prepared for future instances of the same hazard, relative to a community that has rarely or never faced that hazard (Wisner et al., 2003) (e.g.

Bariakarians, who have experienced erosion far more times than have Rajiapurians), prior experience does not necessarily prepare either community for potentially increasing rates of erosion, and changes in timing and therefore predictability with which it may occur in the future under accelerating climate change.

7.3.3. Political ties and corruption

Allegations of corruption in terms of needing to bribe government officials to access social safety nets (SSNs) and larger amounts of flood relief are extremely common among respondents in Rajiapur; however this was not seen to be the case in Bariakari. In the *char* field site, there were no allegations of corruption; here, personal relationships with local government members seem to play a more important role in accessing SSNs. The few respondents in Bariakari who do have personal relationships include households that are slightly better off (those who self-identify as poor rather than extreme poor). In one case, a relationship with the local government chairman seems to put the household in a better position with respect to SSN access and preferential treatment in the aftermath flooding.

In terms of SSN access, 11.5 per cent of respondent households in Rajiapur currently receive some benefits (VGD cards and Old Age Pension (OAP)). The VGD beneficiary households did not report paying for access. In terms of targeting performance, while a huge number of extremely poor households are uncovered in Rajiapur, the VGD beneficiary households did self-identify as extremely poor, and would also be considered extremely poor by participatory wealth-ranking criteria. The OAP beneficiary, on the other hand, reported bribing the local government chairman for access and self-identified as poor (rather than extremely poor), and given asset ownership criteria, would fall at the higher end of the extreme poor range identified during the participatory wealth-ranking.

In Bariakari, 26.6 per cent of respondent households currently receive an SSN benefit (VGD cards and Widow's Allowance). The pattern of corruption seems similar to that in Rajiapur: nobody receiving a VGD card reports having paid for it, but households receiving non-VGD support (Widow's Allowance in Bariakari and OAP in Rajiapur) have paid for access. However, where in Rajiapur the VGD recipients seem to be among the poorest of the poor, in Bariakari they are poor, but slightly better off (by self-identification and peer identification criteria) than other respondent households who are not receiving any SSN. Two of the VGD recipient households (out of three in total receiving VGD cards) in Bariakari have personal relationships with the local government chairman.[73]

[73] The households knew the chairman from having lived in the same village as children. It was not possible to discuss the issue of access to SSN benefits with the chairman himself, as he was not

In both Bariakari and Rajiapur, rates of SSN access among respondents are reportedly decreasing: in Rajiapur, 27 per cent received some SSN five years ago, as opposed to 11.5 per cent currently; in Bariakari, three-fifths of respondent households report having received some SSN (mainly VGD cards) before relocating to Bariakari when erosion forced them to abandon the neighbouring *char*. However by the time fieldwork began, some seven or eight months after the relocation, only half these households were continuing to receive instalments of VGD rice. In Rajiapur, respondents identify lack of access as an issue of corruption:

Box 32: Allegations of local government corruption in Rajiapur

Apon (migrator, Rajiapur): "Who can pay for VGD/VGF they give it to them; who can't pay for it, they do not give to them. We get only 2kg rice during the flood time, they give it to everyone, when the water level goes high, they give to everyone, rich, poor, everyone. But I get nothing else from the government."

Fawzia (agricultural day labourer, Rajiapur): "*Apa*, I want to tell you about it. We are poor people, now member, chairmen, they are selfish people. We don't give them money, so we get less help from them. My husband can't work, they don't even give me distressed mother card. Only 2 or 4kg of rice at flood time."

Ashik (beggar, Rajiapur): "They do not give me any OAP, VGD, nothing. Other people ask me: 'you are poor, you are blind, you have no ability to work, why they don't give you card?' Member, chairman don't give me any help. I have no money. *Sharee*, OAP, these type of help come from the government to the member and chairman, but we do not receive these help, the people who can pay receive this."

In Bariakari, on the other hand, opinions of the chairman are generally higher, possibly because more respondents there reported at least having met the chairman and some having friendships, with one respondent describing him as "a good, honest person." Nonetheless, access for respondents in both sites to government SSNs and relief (as well as some NGO programmes) is mediated, albeit in different ways, by a "culture of corruption" (Marshall, 2010: 17), underpinned by political connections (though these are few among the respondent group), and bribery.

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interviewed as part of this research. This, however, was not for lack of trying—on three different occasions the chairman missed scheduled interviews, and failed to attend the seminar that was held at the end of the fieldwork period to share preliminary findings with local NGO and government members. The local chairman for the Rajiapur community, on the other hand, was very responsive, participated in an interview, was candid about governance issues, and attended the end of fieldwork seminar with great interest.

In terms of accessing other kinds of support, one of the two households who know the chairman in Bariakari also received a free deep tube well as a gift from the chairman, and reports being able to access and use the chairman's boat if needed for moving to a flood shelter during severe flooding:

Box 33: Ties with the chairman and coping with floods

> Zahir (agricultural day labourer, Bariakari): "Now flood is coming, when we will see that the fence around the house goes under water, we raise the bed, and when we will see that the bed is going under water also, then people will bring boat by hire to go higher place. For us the chairman is there, he will give boat when we need. We will call him."

The excerpt above also illustrates the notion of *coping thresholds*, with increasingly severe flooding requiring increasingly costly coping measures. In this respondent's case, relying on political connections characterizes the later stages of coping as the effects of flooding intensify (Wisner et al., 2003).

In addition to paying for access to SSNs and/or relying on relationships with local government members to access benefits, access to some NGO and government programmes for extremely poor respondents is mediated in other ways, for instance through locally powerful men, as in the case of 'middlemen'. These individuals use their political connections for personal gains by acting as intermediaries between NGOs/donors, local governments, and communities, demanding bribes for including names on a list of suggested beneficiaries, leaving off the names of those who cannot pay.

The SSN and NGO programmes that operate in both field sites help to reduce poverty and vulnerability through, for instance, provision of basic services (e.g. health, education), and access to basic amenities (e.g. water, sanitation). In terms of vulnerability to impacts of climate-related hazards, they go part of the way towards supporting the capacity of poor rural people to cope and adapt (CCCD, 2009; McGray et al., 2007). Of course this is only to the extent that these programmes reach intended beneficiaries; corruption not only impedes access by extremely poor people to these benefits, but the failure to address the exclusion and persistence of poverty that corruption exacerbates means future programmes are likely to suffer the same fate.

7.3.4. Information about climate and weather

Respondents' perceptions about certain changes in climate over recent decades broadly match meteorological data, for instance on changes in temperature and drought patterns (Rajib et al.,

2008; Islam and Neelim, 2010; Shahid, 2010) (Chapter 6, Section 6.5.1.2), as well as an increasing trend in the incidence of erosion (Uddin and Basak, 2012). A majority of the autonomous coping strategies analysed in this chapter are based on indigenous knowledge and practices that have been used in the area for generations. In relation to floods, for instance, most pre-flood preparation and coping strategies described in Section 7.2.1 are autonomous, have been passed down through the generations, and are based partly on indigenous weather prediction methods.

Most respondents report that intimate knowledge of seasonal patterns is the most common strategy for predicting when events like flooding and storms will occur—e.g. historically, floods begin at the end of summer and last through the monsoon, and knowledge of this pattern underpins flood prediction and determines the timing of preparation activities. Observations include: (1) rainfall patterns—specifically when rain falls heavily and continuously for at least three days in a row, floods will follow shortly thereafter, especially if rainfall comes from the north; (2) the direction of cloud movement; and (3) the speed and pattern with which the water level in the river increases:

Box 34: Local weather prediction methods

> Anika (beggar, Rajiapur): "We know that in mid-June to mid-August floods will happen. In these months one day you will see there is less water in the river. Then the day after you will see the river is full with water, and then the day after that you will see everything is flooded. It happens in this way."
>
> Tanisa (non-working respondent, Rajiapur): "Three is an old saying, we learn from it: '*uthore te dogomago, poschime ban budisale fol pore pathore soman*'. It means when the clouds are in the north side of the sky, then storm must happen, and when the clouds are in the west side, then flood will happen."

Given recent changes in climate, a great deal of literature on local coping responses and the indigenous climate prediction methods they are based on, report that these have become less effective in recent decades. This, however, does not seem to be the opinion among respondents in this research, presenting a seeming disconnect between widespread reports of shifting seasonal patterns and changes in some climate-related extreme events, on the one hand, and respondent claims, on the other, that indigenous prediction methods remain effective, regardless of changes in the historical flood pattern upon which indigenous flood prediction largely depends.

However, there is some evidence that the relative importance of different sources of information may be shifting. Access to media (TV, newspapers, and radio) is still less

important than information obtained through social networks and relationships, but most respondents report receiving more weather-related information and warnings from the media than in the past. Men usually have better access because of their presence in the markets, and literate men have the most direct access, but the information is usually shared and discussed, not only in the market, but also (to a somewhat lesser extent) in the village and home. Dinar et al. (2008) and Maddison (2006) report similar findings on the opportunity to exchange information in market settings and the role this played in awareness and knowledge about climate change in several African countries. Most respondents also report receiving little to no information from local NGOs or local government about climate and weather patterns, although those who are members of some local development/NGO programmes do participate in some awareness raising activities.

However, while respondents do rely to a certain extent on TV and radio for information about weather and in particular extreme weather warnings, interview and FGD data indicate that this information would be more useful if tailored to the local area and respondent needs. This also applies to the weather-related information disseminated by local NGOs. In preparation for flood season in Bariakari, for instance, the CLP runs a series of FGDs about preparing for and coping with the effects of flooding. Respondents report that these discussions are of minimal practical use to them since they focus attention on indigenous coping activities that are already undertaken by flood-affected households (storing food, raising beds, creating boats from banana trees, etc.).

This touches on the importance of not only disseminating information about weather patterns and climate change, but the *kinds* of information that is disseminated, and how, and whether or not it responds to local needs and supports agency on behalf of communities, equipping them to make informed choices (Levine et al., 2011; Ensor, 2011).

7.3.5. Perceptions of climate change and beliefs about its causes

As discussed in sections above, very few respondents report having changed coping responses, despite having perceived changes in the climate-related shocks and stresses over recent years.

Box 35: 'What more can we do?'

> Kabir (fisherman, Bariakari): "We have to save money, food, fuel and make moveable stove… We have to raise our bed. If the tube well is flooded we have to take water from river and take it by boiling. We always have done the same thing. Our forefathers have done these things too. We have to survive like this, nothing has changed. Whatever, if the flood is more or less, we do the same things, what more can we do?"

The reasons underpinning lack of change in behaviour vary across specific climate-related hazards, but overall, the observation quoted above illustrates the important role of perceptions of climate change by extremely poor people, relative to other sources of risk and vulnerability, and barriers and limits to undertaking more extensive or proactive coping for extremely poor respondents.

With respect to drought, which a significant share of the respondent group perceives as increasing in recent years, the lack of changed behaviour to cope with associated effects seems to be related mainly to the perception that drought, and increased drought, does not pose a major risk to respondent livelihoods in Rajiapur and Bariakari, relative to other hazards. This is likely due to the fact that a relatively small share of extremely poor households are involved in agricultural production. Furthermore, while drought is widely perceived to have increased in recent years, this does not seem to be affecting availability of water for household use in a very significant way.

On the other hand, respondents do perceive flooding, erosion, and storms as major sources of risk to their livelihood security. However, again, very few respondents report changing their coping responses to floods. This raises the question then of barriers and limits to adaptive action. In relation to both flooding and erosion, there is a certain degree of consensus among respondents that both are increasing, however significant financial barriers exist to undertaking the kinds of activities that would reduce respondents' vulnerability to impacts. In discussing what respondents would do to deal with the effects of flooding and erosion if they could do anything, almost 100 per cent of respondents indicated moving to an area "far from the river" that was raised and not flood or erosion prone. Respondents also highlighted other coping strategies they would undertake if they could afford to, including raising their homes and storing enough food for flood season:

Box 36: Financial barriers to coping

Ruma (maidservant, Rajiapur): "If I had money, I would buy a land in the main land. I don't want to see this things again (flooding and riverbank erosion). I would go to mainland and buy a new land and stay there."

Rezaul (sharecropper, Bariakari): "At the flood time water level increase so much. People dig earth and raise their house but I can't do this because I've no money by which I dig earth or hire labourer."

Riya (non-working respondent, Rajiapur): "If I had enough money, I choose a land which is raised and I buy tin and make a good house, in the flood time I stay there."

Asfar (agricultural day labourer, Rajiapur) "I would save money, more food for flood. Also more hay for the cow and food we wouldn't have to take *dena*."

Indeed, both field sites are flood and erosion prone areas, and being extremely poor, respondents inhabit the areas that are most at risk within these already ecologically fragile areas. This greatly limits the possibilities in terms of successful, proactive coping. In other words, they are not changing their behaviours because they are already doing all they can. To the extent that flooding and erosion increase in future, and financial barriers continue to make it impossible for them to move to other areas, the only option for respondents seems to be to "bear losses" associated with these effects (Burton, 1996; Burton et al., 1998). The same seems true with respect to coping with storms for respondents in Bariakari—to the extent that they cannot afford to build their homes out of more durable structures, and government or NGOs do not build schools, or flood shelters, or wealthier individuals do not move into the area and construct their homes out of concrete (like is the case in Rajiapur), there is little these respondents can do to increase their potential for more successful coping.

One caveat with regard to lack of changes in coping with storms should be raised: that opinions about whether or not storms are actually changing are incredibly divergent across the respondent group. Therefore, the need to change coping strategies in the first place may not exist as it may with flooding and erosion. Regardless, financial barriers seem to be particularly important across all three hazards for the extreme poor.

In relation to beliefs about the causes of climate change, some local community members had engaged in climate change awareness raising activities with local NGOs, but this was not the case for everyone, and levels of information and understanding vary greatly. In general, while there is some awareness among poor and non-poor people of causes and global dimensions of climate change, there is virtually no such awareness among extremely poor respondents, who instead conceptualize observed changes in climate as divine acts. There is a broad sense across the respondent group that if it is the wish of *Allah* to destroy one's homestead land or

wash away livestock, these are inevitabilities, regardless, to a certain extent, of activities undertaken by respondents to manage the risks. The increasing frequency of damaging climate events is commonly regarded as punishment for what respondents describe as a breakdown of morality in modern society:

Box 37: 'It is the wish of Allah'

> Torun (boatman, Bariakari): "The time has changed. Even men also changed. They have changed. Before they were loyal. Now they betray with others. They have no morality. The floodwater is supposed to come in *Ashar* month [June]. But weather has changed, because the people have changed. So the flood comes now [May]. The floodwater that comes now, it didn't used to come now, it used to come at the end of June and July, but it is coming now. It is the wish of *Allah*".

On the one hand, respondents do conceptualize changes in climate and put the end result of their coping efforts down to divine will. At the same time, they do still make every effort within their ability to protect themselves and their possessions from climate-related shocks and stresses. This seeming disconnect is resolved in the belief that divine beings reward individuals for their hard work and effort. This points to the importance of contextual factors—in relation to, for instance, the role of "values and ethics...knowledge, and culture" in defining not only social limits to adaptation (Adger et al., 2009), but also potential entry points for spreading knowledge about climate change and fostering autonomous adaptation.

7.3.6. Constraints and opportunities presented by mediating factors

Table 33 summarizes the opportunities and constraints posed by the different mediating factors discussed above for coping with various hazards.

Physical capability and good health are critical in that they allow respondents to work as much as possible, both during normal times and when coping with the effects of climate-related shocks and stresses. Disabled and chronically sick individuals often must rely on others and/or beg, placing them at a disadvantage with respect to earning sufficient income to cope with the effects of shocks and stresses, and even in terms of physically protecting themselves from events like flooding. At the household level, having a member who is in poor health, not working, and possibly also requiring treatment represents another major source of impoverishment highlighted by respondents in both sites. These households often engaged in distress coping as a result, for example selling income-generating livelihood resources. In lieu of access to impartial law enforcement and justice institutions for extremely poor respondents, physical capability also becomes essential in terms of protecting or enforcing one's right to land.

Community and family networks provide some community members (those who know each other well and have enough resources to reciprocate) with access to the unofficial community safety net known locally as *dhar koroj*. However this only provides protection from the impacts of idiosyncratic shocks, since this system tends to become overwhelmed in the case of covariate shocks, during which times family networks extended over larger geographical areas become essential for respondents. The capacity to engage in collective decision-making becomes a resource for coping in certain circumstances, such as in Bariakari where respondents come together to decide where to move after being affected by erosion. The central role of community and family networks in underlying response to different kinds of shocks and stresses is a testament to the low levels of access that respondents have to planned interventions like government safety nets. While expansion of social safety nets and agricultural research and extension have played an important role in reducing rural poverty generally in Bangladesh (BBS, 2010), access to these services is still quite limited among the extremely poor respondent group.

With respect to ***political ties and corruption***, those individuals who happen to have relationships with locally powerful men or members of local government tend to receive preferential treatment in accessing official government assistance and relief, however a majority of respondents face barriers to accessing their fair share of government assistance due to corruption. While the expansion of SSNs has played an important role in reducing rural poverty in Bangladesh (BBS, 2011b), the trend for respondents in both sites is one of decreasing access over the last five years. Relatively more extremely poor respondents are part of local NGO programmes than in the past, however reports of bribing middlemen to gain entry are common. The benefits of accessing these programmes would enhance adaptive capacity among respondents, as they aim to address poverty and vulnerability through, for instance, provision of basic services (health, education), access to basic amenities (water, sanitation), and transfer of income-generating assets (as in the CLP).

Data indicate that there is an increase in access to ***information about climate and weather*** through radio and TV, and some respondents report learning about certain coping strategies from watching TV broadcasts, for instance the technique of binding a clean piece of cloth to the mouth of a tube well during flood season in order to filter the water. However, respondents also report that media broadcasts are rarely tailored enough to local conditions to be useful in planning risk management activities *before* shocks occur. Along similar lines, some respondents report that awareness raising activities organized by some local NGOs about coping with the effects of floods are not particularly useful, since they focus on indigenous strategies that respondents already undertake, rather than on new opportunities or

support for coping. Local weather prediction methods are based largely on historical experience and knowledge of timing of seasons and weather patterns. While respondents do not report directly that these are becoming less reliable, many of them do perceive that they are more often surprised by the onset of certain climate-related events, such as flooding.

Perceptions of climate change and beliefs about the causes influence the way people conceptualize, prepare for, and respond to shocks (Kasperson and Kasperson, 1996). The belief that perceived changes in the climate are the result of divine beings punishing society for a breakdown in morality, and that ultimately, the results of coping efforts are out of one's hands, in some cases may discourage respondents from coping. However, for most respondents, on the contrary, this belief encourages them to do everything in their power to protect themselves and their livelihoods from the impacts of climate-related shocks and stresses. This is reportedly because of another common view, that divine beings rewards individuals for their hard work and effort. In terms of perceptions of climate change and implications on livelihoods, to the extent that perceptions of risks posed by different hazards vary within the family/community, this can sometimes impede decisive individual/collective action. Findings suggest clear but complex links between perceptions of climate and non climate-related sources of risk and vulnerability, including the livelihood impacts from perceived changes in climate, as well as beliefs about why climatic changes are happening in the first place, and respondent motivations for coping and adapting.

Table 33: Mediating factors, constraints, and opportunities for coping

Mediating factor	Hazard	Constraints	Opportunities
Physical capability/ health	All hazards	Poor health/disability - incapable of working, or only able to work part time thus reduced income/ resources for coping and dependence on others; increased dependency ratio at HH level	Physical ability to work - earn income/resources for coping
	Flooding/ erosion/storms	Physically disabled - must rely on others to remove oneself from danger	Mobile and capable of protecting oneself from physical danger during flooding/erosion/storms
	Conflict over land	Old age/physical incapability or weakness/few men residing in HH – unable to enforce rights to land	Many male HH members in good physical condition able to enforce one's right to land in lieu of legal/justice institutions
Community and family networks	Covariate shocks (e.g. regional flooding, drought)	Local unofficial safety net (*dhar koroj*) overwhelmed given widespread impact	Rely on family networks, those residing in other districts
	Erosion		Collective relocation following erosion (Bariakari only)
	Idiosyncratic shocks (e.g. health shocks, loss of job, death of husband)	Poorest of the poor excluded from *dhar koroj;* new community members excluded (system depends on familiarity between community members)	Local *dhar koroj* operates for borrowing small amounts of food and money between community members
		Widows often forced off land after death of husband by husband's family	
Political ties and corruption	Flooding	Lack of access to flood relief due to corruption	Access flood relief through bribery
	All hazards[74]	Lack of access to SSNs and NGO programmes due to need to bribe middlemen	Access SSNs/NGO programmes and resources (e.g. tube well) through bribery and/or relationship with local government members and/or local elite

[74] To the extent that involvement in NGO programmes and government SSNs contributes to general vulnerability reduction.

Information about climate and weather	All climate-related hazards Flooding	Local prediction methods less reliable than in past (respondents more often surprised by weather patterns/extremes) Media information about climate/weather often not regionally tailored enough NGO awareness raising around flood coping not relevant to respondents	Increased access to information about weather and climate through media (TV, radio), some of which is relevant to local conditions and coping
Perceptions of CC and beliefs about causes	Changes in climate (weather patterns and extremes) All climate-related hazards	Belief in divine causes for climate change, may in some cases lead to belief that solution/coping is out of one's hands To the extent that perceptions of risks posed by different hazards vary within the family/community this can impede decisive individual/collective action	Belief that divine beings reward people for their coping efforts encourages most respondents to do everything in their power to address livelihood impacts from climate-related hazards

7.4. Conclusions

This chapter analyses autonomous and intervention-based coping and adaptive responses to the effects of climate-related shocks and stresses in Rajiapur and Bariakari. The findings presented above relate to the research question: *What indigenous autonomous coping and adaptation activities are already in place at the community and household levels?* The data also relate to the following hypothesis: *several 'mediating factors' shape levels of differentiation in vulnerability across respondents and influence coping and adaptive responses.*

Main findings around coping strategies highlight issues around: timing, sequencing, and thresholds of coping (Tables 31 and 32); patterns of differentiation and commonality in coping across respondents (Table 30); and the factors and processes that mediate the ability, willingness, and success of respondents in addressing the effects of climate-related impacts (Table 33). Major findings with respect to these areas include: (1) that certain *coping thresholds* exist beyond which more costly coping strategies must be implemented in order to avoid significant loss or damage to livelihood resources. However, in many cases limits (often

financial) exist for extremely poor people in undertaking more substantial coping. (2) There is a great deal of differentiation across respondent households and individuals when it comes to coping, however patterns of commonality also emerge. At the inter-household level, differentiation relates largely to the principal livelihood activity a respondent is involved in when a given shock occurs, implying different kinds of coping to address the effects on work opportunities. At the intra-household level, differentiation in coping relates largely to gender-based norms dictating the roles and responsibilities for undertaking different coping activities. Further patterns of differentiation are based around whether mediating factors present opportunities or constraints for certain individuals as they cope with the livelihood effects of shocks and stresses. Patterns of commonality emerge around activities that are undertaken to protect common household resources that are important to respondents across the board. (3) Mediating factors influence vulnerability and coping both by shaping access to resources (e.g. good health, housing, jobs, SSN benefits) and influencing the 'motivational context' for adaptation (Haddad, 2005) (e.g. beliefs and perceptions about climate change).

As illustrated in Table 33, mediating factors can present both constraints and opportunities for coping with shocks and stresses for different respondents. Constraints posed by the different mediating factors illustrate that significant barriers exist with respect to undertaking more sustainable, long-term adjustments that may make livelihoods more resilient to changing climatic conditions and extremes (Vogel, 1998, cited in Smit and Wandel, 2006: 287). On the other hand, mediating factors may also present opportunities for coping for some respondents (as illustrated in column four of Table 33). However, balancing the constraints and opportunities that mediating factors present in terms of coping with climate-related shocks and stresses, it appears that most extremely poor respondents are pushed towards strategies for survival rather than 'strategies for success' (Ziervogel et al., 2006). To the extent that climate-related shocks and stresses are becoming more frequent, intense, and less predictable, respondents seem to be more than anything "bearing losses" (Burton, 1996; Burton et al., 1998) from the effects on livelihoods from climate variability and change. The major finding of this chapter—and indeed of this research—is therefore that there seems to be little that could be termed 'adaptation' occurring among extremely poor respondent households; rather much of the response activity to the impacts from climate-related shocks and stresses remains short-term, reactive, coping.

Chapter 8:
Conclusions and implications

8.1. Introduction

This chapter summarizes the main findings of this research, and draws practical and theoretical implications for climate change vulnerability and adaptive capacity among extremely poor individuals and households. The primary data collected for this thesis set out to answer the questions: *What is the nature of climate change vulnerability among extremely poor households in Rajiapur and Bariakari, Northwest Bangladesh? What are local perceptions about climate and non climate-related risks, and livelihood coping and adaptation needs and constraints*. Fieldwork was guided by the hypotheses that impacts associated with climate variability and change are altering the pre-existing vulnerability context, and affecting livelihoods of extremely poor households and individuals in differentiated albeit undocumented ways. Patterns of differentiation in vulnerability and in response across respondents are underpinned by certain mediating factors.

A Mediating Factors Framework, based on a livelihoods approach, was used to guide data collection and analysis, with a focus on elements that may comprise climate-related vulnerability, on the one hand, and those that may influence levels of adaptive capacity, on the other. In this thesis, vulnerability is viewed as a context that shapes people's exposure, sensitivity, and capacity to adapt to shocks and stresses—climate-related or otherwise (Adger, 1999; Kelly and Adger, 2000; Allen, 2003; Wisner et al., 2004). Emerging frameworks for exploring adaptive capacity at the individual and household levels also informed this research (Adger et al., 2007; Smit and Wandel, 2006; Marshall et al., 2010; Chapin et al., 2006; Levine et al., 2011; Ensor, 2011; CCCD, 2009).

Section 8.2 summarizes the main findings from this research, beginning by listing the research hypotheses set out in Chapter 3 (Section 3.3), and indicating whether they are supported by data collected during fieldwork. Following this, the main research findings are reviewed, including: (1) vulnerability is differentiated across the respondent group, however patterns of commonality also exist. (2) Little evidence suggests that adaptation is occurring among extremely poor respondents. Much of the response activity currently undertaken to address impacts from climate-related events is short-term coping. (3) Several mediating factors emerge as important for respondents in coping with livelihood impacts from climate-

related shocks and stresses. These present constraints and opportunities for coping through influencing both access to resources (e.g. health, secure housing, jobs), on the one hand, and the 'motivational context' (Haddad, 2005) for adaptation (e.g. beliefs and perceptions about climate change), on the other. The sub-sections summarizing these findings are structured according to: patterns of differentiation (Section 8.2.1), areas of commonality (Section 8.2.2), and mediating factors (Section 8.2.3). Section 8.2.4 presents a results Mediating Factors Results Framework illustrating as an example the ways in which political ties and corruption mediate coping and outcomes in terms of perceived post-shock levels of poverty and vulnerability.

The chapter concludes in Section 8.3 with a discussion of implications of research findings for research and design of pro-extreme poor adaptation (Section 8.3.1), methodological approaches for generating empirical data on extremely poor people, and suggestions for future work in this area (Section 8.3.2).

8.2. Main research findings

The following three hypotheses were set out for this research:

(1) Climate change is altering the pre-existing vulnerability context for extremely poor communities in the field site areas.
(2) Climate change vulnerability is differentiated among extremely poor households and individuals.
(3) Several 'mediating factors' affect this differentiation and influence local coping and adaptive responses. Data collected during fieldwork in Rajiapur and Bariakari support all three hypotheses.

In relation to the *first hypothesis*, data presented in Chapter 6 indicate that respondents do perceive changes in climate, both with respect to extreme events and weather and seasonal patterns (Tables 25 and 26, Section 6.5.1). Furthermore, respondents indicate that these changes are altering vulnerability by affecting their livelihoods, mainly through exacerbation of the degree of impact on household and livelihood resources caused by climate-related shocks and stresses that have historically occurred in the fieldwork sites, for example through prolonged periods of flooding; and also through increasing unpredictability of work available at certain times of the year (in particular during flood season) (Sections 6.5.1.1 and 6.5.1.2). These changes have also made it more difficult to cope with other, non-climate related sources of risk and vulnerability, such as dowry payment requirements, since it is most often

the overlap of climate and non climate-related shocks and stresses that causes the greatest impoverishment or entrenchment in poverty for the respondent group (Section 6.4). In this way, perceived climate change is altering the pre-existing vulnerability context for respondents in both field sites.

With respect to the *second hypothesis*, data presented in Chapters 6 and 7 indicate that there are both patterns of differentiation and some patterns of commonality in climate change vulnerability among the livelihood and social groups that comprise the core respondent group, among individuals within these groups, and across the two fieldwork sites. These various patterns of differentiation and commonality are reviewed below in Sections 8.2.1 and 8.2.2, respectively.

Data also supported the *third hypothesis*, that several mediating factors affect and underpin the various dimensions of differentiation in vulnerability, and influence local coping and adaptive responses. The particular set of mediating factors that were highlighted as relevant by respondents in the two fieldwork sites is reviewed in Section 8.2.3.

8.2.1. Patterns of differentiation

Vulnerability was found to be differentiated across the respondent group, with respect to: patterns of exposure and sensitivity to different climate-related shocks and stresses; perceptions of climate change and relative risks associated with different climate and non-climate-related shocks and stresses; and coping and adaptive responses undertaken by respondents. Differentiation in vulnerability has various dimensions, including livelihood differentiation (and related to this, temporal differentiation), social group differentiation, and locational differentiation.

Livelihood differentiation relates to differences in how climate-related shocks and stresses affect respondents based on the livelihood activities they are engaged in when a given climate-related event occurs. Differentiated patterns of response, in turn, emerge from these livelihood-based differences in impact. For instance, extremely poor households dependent on agricultural day labour—a livelihood activity severely affected by flooding—dedicate relatively more time and resources to pre-flood preparation activities in anticipation of being unable to work during the floods, than do extremely poor households dependent on river-based work, which remains viable during flood season (Section 7.2.1).

Temporal differentiation also characterises the coping strategies undertaken across respondents dependent on different livelihood activities. This relates to different *coping*

thresholds, or sequences (Blaikie et al., 1994; Corbett, 1988) of increasingly costly coping activities that must be undertaken due to increasing degree of impact from climate-related events on particular livelihood groups. Greater degrees of impact push coping past successive thresholds into more costly and difficult activities along a coping threshold continuum (Tables 31 and 32, Section 7.2.4.4). Different kinds of hazards imply different coping thresholds across respondents depending in large part on the sensitivity of their primary livelihood activities to a given climate-related hazard.

Differences also emerge in the ways that climate-related events affect particular ***social groups,*** including men, women, children, elderly, and disabled individuals. This kind of differentiation relates both to health and physical ability to withstand certain climate conditions, on the one hand, as well as to differential roles and responsibilities for coping (usually gender-based), on the other (Section 7.2, and Table 30, Section 7.2.4.4).

Locational differentiation was also found between the two field sites with respect to perceptions of the relative importance of particular climate-related hazards within the wider context of multiple stressors that affect the livelihoods of extremely poor respondents. There are differences both in perceptions of the role that various kinds of shocks and stresses have played in shaping poverty trajectories over time (Tables 28 and 29, Section 6.5.2), and in perceptions of the risks respondents attach to different hazards going forward (Table 24, Section 6.4). Climate-related shocks and stresses were identified as having played a central role in what many respondents perceive as increasing levels of household poverty over recent years. However, the manner in which commonly highlighted drivers of poverty—for instance erosion—had impacted livelihoods varied significantly between the two field sites and, within these, across individuals and households. This variation often reflected barriers and constraints faced in coping related to mediating factors, for instance whether a respondent's community or family networks could be called upon to secure new pieces of land, or whether they were facing major family health issues simultaneously (Table 33, Section 7.3.6).

With respect to perceptions of risk going forward, while both respondent groups produced a nearly even 49:51 per cent split when weighting the relative importance between climate and non climate-related sources of risk (Figures 8 and 9, Section 6.4), the distribution of individual risks within each category varies significantly. In other words, different concerns are important to the people in these two locations.

8.2.2. Areas of commonality

Areas of commonality were also found, for instance in certain features of livelihoods across

extremely poor respondents in both sites, in perceptions of risks and livelihood impacts from climate change, and in some coping strategies undertaken across all households, towards protecting homesteads and very limited household resources.

Certain common features relate to ***the principal livelihoods*** of extremely poor respondents in both field sites. The characteristics that stand out include the seasonal and climate-sensitive nature of the work in which most respondents engage (for example agriculture and river-based wage labour) (Section 5.4), and related to this, the widespread tendency towards diversification of income sources. The tendency to self-identify with one livelihood activity over others is also common across respondents, with some identifying a hierarchy whereby agriculture is locally considered to be more prestigious and secure compared with other activities, namely fishing. This reflects the part that local norms, culture, and religious beliefs play in shaping perceptions about different kinds of work in the local area (Section 5.4.8).

Commonalities also emerge in ***perceptions of risks and livelihood impacts from climate change***. While respondents' views on the relative importance of different kinds of hazards vary, a common theme about the vulnerability context emerged in stories from across the entire respondent group: that it is the overlap of climate and non climate-related shocks and stresses, and the inability to cope with impacts from various shocks and stresses simultaneously, that shape poverty and vulnerability trajectories over time and the feasibility of risk management strategies going forward (Section 6.4).

With respect to perceptions about climate change, while there are divergent opinions on some points among those respondents who do perceive that changes are occurring, ***perceptions of how climate change is affecting livelihoods*** are almost unanimous (Sections 6.5.1.1 and 6.5.1.2). These respondents feel that the availability of work that was already highly seasonal and sensitive to weather patterns is becoming increasingly unpredictable, because those weather patterns and the nature of some climate extremes are changing. This problem is becoming particularly acute at certain times of the year, for example respondents find the availability of agricultural work during and around flood season increasingly unpredictable, as well as knowing when to time migration in the lead up to flood season. Furthermore, the amount of time between climate-related shocks and stresses is becoming increasingly short, rendering some local coping strategies less effective than in the past. These changes pose additional layers of complexity for respondents in dealing with the impacts that climate-related shocks and stresses have historically had on livelihoods in the local area.

Some coping strategies are common across all respondent households, resulting from the fact that climate-related shocks and stresses create ***similar problems for most homesteads and the***

very limited household resources of extremely poor respondents, including access to basic amenities (e.g. water and sanitation). Consequently, there is widespread reliance on certain ***indigenous risk management and coping strategies*** aimed at protecting homesteads and household resources, for instance, raising beds, making moveable stoves, storing food, and building makeshift boats to use as latrines. There is gender- and age-based differentiation in undertaking coping tasks at the intra-household level, but patterns are common across households (Table 30, Section 7.2.4.4). Respondents also exhibit more ***internal organizational capacity***, supported by collective decision-making, than might be obvious at first. This is reflected, for instance, in the coordinated movement of groups of households from one *char* to another (Section 7.2.3.2).

Finally, ***diversification of income sources*** plays a common role in coping, as respondents switch among different income-earning activities in response to seasonality and climate-related shocks and stresses. Furthermore, there is some evidence of willingness to make more than minor changes, as exhibited by respondents in Bariakari, who, with support, were willing to shift to HYV maize production.

While the adoption of these various coping strategies illustrates respondents are not passive victims of climate or other shocks (Wisner et al., 2004), at the same time, there seems to be ***little to no autonomous adaptation occurring***. Despite a large share of respondents perceiving changes in climatic conditions, the effects of which are adversely impacting their livelihoods, local coping strategies are *not* changing. In other words, the residual impacts from climate variability and change after coping may be "bearing losses" (Burton, 1996; Burton et al., 1998) from changing conditions (e.g. temperature, precipitation) and extremes (e.g. severe flooding, riverbank erosion). This implies that significant limits (Adger et al., 2009; Brouwer et al., 2007) exist across the respondent group with respect to engaging in more successful, proactive coping and adaptation (Table 32, Section 7.2.4.4; Table 33, Section 7.3.6).

8.2.3. Mediating factors

Various models exist for conceptualizing the role of wider contextual factors in shaping how people organize their livelihoods and cope with shocks and stresses, e.g. transforming structures and processes (DFID, 1999); policies, processes, and institutions (DFID, 1991); transforming processes (Carney, 1998); contexts, conditions, and trends and institutions and organization (Scoones, 1998), and more broadly, internal and external factors (Ellis, 2000). The Mediating Factors Framework developed for this research was informed by these

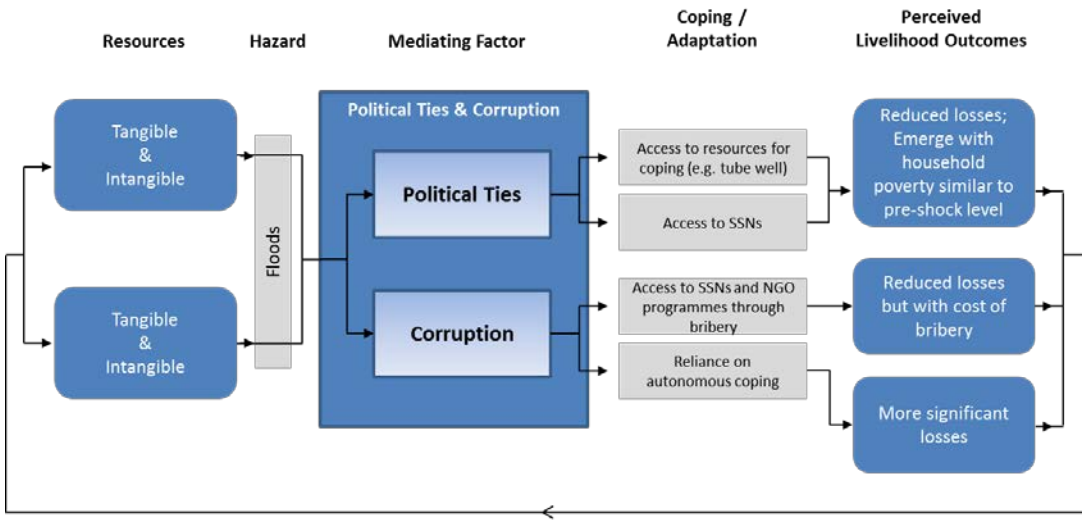
approaches, but allowed space for respondents themselves to define what factors and processes mattered to them, rather than selecting a pre-defined list of options. In this way, the approach was participatory (Loizos and Pratt, 1992), involved 'handing over the stick' (Chambers, 1997), and throughout prioritized local people's knowledge and experience.

For this group of extremely poor respondents, what emerged was a combination of tangible and intangible factors and processes that underpin patterns of differentiation and commonality in levels of vulnerability and in responding to impacts from climate-related shocks and stresses. These include: (1) physical capability and health; (2) community and family networks; (3) political ties and corruption; (4) information about climate and weather; and (5) perceptions of climate change and beliefs about the causes. These factors influence both access to resources essential for livelihoods and coping, for instance good health, money, work, land, livestock (mediating factors 1-3), and the 'motivational context' (Haddad, 2005) for coping and adaptation, for example respondent beliefs and perceptions about climate change, including access to information about weather patterns and global dimensions of climate change (mediating factors 4-5). They influence how respondents conceptualize causes of perceived changes in climate, and perceptions of whether related impacts are critical, compared to other shocks and stresses. The ways in which mediating factors operate across individuals and households pose both opportunities, on the one hand, and constraints, on the other for respondents as they cope with the effects of various shocks and stresses (Table 33, Section 7.3.6).

8.2.4. Mediating Factors Results Framework

The findings presented in Chapter 7 characterize some of the ways that the mediating factors raised by respondents influence coping and outcomes, with respect to both poverty and vulnerability to future shocks and stresses, and the motivational context for adaptation, i.e. respondent attitudes, perceptions, and beliefs about climate change and adaptation. As an example of this relationship, the results framework, shown in Figure 10, provides a graphic illustration of how political ties and corruption influence coping and outcomes for respondents.

Figure 10: Mediating Factors Results Framework: example of political ties & corruption influence on coping and perceived livelihood outcomes



In the above diagram, respondents possess a defined set of tangible and intangible resources before the onset of a climate-related shock (in this case floods). Their coping/adaptation experiences vary, mediated by the extent to which they are able to draw on political ties and/or engage in bribery and this, in turn, affects their perceived livelihood outcomes. The results (livelihood outcomes) then form the basis for a new set of tangible and intangible resources that they possess, before the onset of the next shock. In some cases the stock of resources will have changed very little, in others more so, depending on how the mediating factor influenced the coping/adaptation strategy.

8.3. Implications of research findings

The findings from this research have implications for: (1) better understanding of the differentiated characteristics and needs of extremely poor people and households, with respect to climate change vulnerability, adaptation, and adaptive capacity; (2) prioritizing interventions to reduce vulnerability and build adaptive capacity among extremely poor communities, and ways to adjust on-going livelihood and poverty reduction interventions to account for climate change-generated needs of these communities; (3) the methodological approach undertaken here and suggestions for future strands of research.

8.3.1. Implications for better understanding of vulnerability, adaptation, and adaptive capacity among extremely poor people and households

Findings of this research contribute to the evidence base for emerging pro-poor perspectives in the climate change literature. In particular, data provide insights into the factors that shape vulnerability, adaptation, and adaptive capacity for extremely poor people—often called the "most vulnerable" to the impacts of climate change but who have been the subject of relatively little climate change research. More specifically, patterns of differentiation and areas of commonality in vulnerability levels across respondents in Rajiapur and Bariakari, and the role of mediating factors in coping and adaptation, provide insights into the links between poverty and climate change vulnerability, and potential indicators of adaptive capacity at the individual and household levels for extremely poor people.

This research provides empirical support for the view that vulnerability to the impacts from climate variability and change is context specific and differentiated. This differentiation is shaped by both the nature of climate-related hazards, and by a range of non climate-related factors and processes that mediate levels of exposure and sensitivity to impacts, and adaptive capacity across groups and individuals (Adger, 2006; Field et al., 2012; Allen, 2003; Eriksen et al., 2005). For this group of extremely poor respondents, the non climate-related factors and processes that emerge as important determinants of vulnerability and adaptation operate both by shaping access to more tangible resources (e.g. jobs, durable housing materials, water, sanitation, and health), and by influencing the motivational context for coping and adaptation (e.g. beliefs and perceptions about climate change). These findings underscore the importance of situating the effects of climate-related shocks and stresses within the wider context in which people establish and conduct their livelihoods (Blaikie et al, 1994; Adger, 1999; Kelly and Adger, 2000; Allen, 2003).

With respect to approaches like sustainable adaptation, that seek to highlight the processes and factors that lead to "failure to secure well being in the context of climate-related stresses" (Eriksen and O'Brien, 2007: 340), findings provide insights on the links between poverty and vulnerability to climate change. In particular, findings highlight the factors that shape differential vulnerability across people within the extremely poor respondent group, and between extremely poor respondents and non-poor community members.

Respondents pursue their livelihoods in a context of managing multiple sources of risk, often simultaneously, and coping with impacts from various shocks and stresses, of which climate comprises one kind among many. Many respondents perceive changes in general climatic

conditions, and in the timing and intensity of some climate extremes over recent years that are affecting livelihoods in significant ways, through for example, increased unpredictability of work availability during some seasons. There is little evidence, however, that respondents are changing their coping strategies in response to perceived changes in climate.

This implies that the concepts of barriers, limits, and constraints to adaptation (Nielsen and Reenberg, 2010; Adger et al., 2007; Adger et al., 2009) are particularly relevant for exploring climate change vulnerability among extremely poor communities. Some of these limits relate to common features of livelihoods among extremely poor respondents, for instance, the fact that their room for manoeuvre and scope for decision-making are far more circumscribed than for the less or non-poor in the local area. If they own any land, it tends to be very small plots, and most are landless; they depend largely on daily wage labour, the demand for which depends on resources that other people own. The extent to which those resources are climate-sensitive or not is in part determined by decisions made by others.

In terms of extreme poverty-climate change vulnerability links, a central implication of this research is that climate-related shocks and stresses may become an increasingly important driver of poverty for extremely poor people, to the extent that weather patterns and climate extremes continue to shift, and respondents continue to face barriers to implementing longer term adaptation.

Another major finding of this research is that vulnerability and adaptation for extremely poor respondents is shaped both by access to tangible resources and by the ‘motivational context’ for adaptation (Haddad, 2005), which here includes beliefs and perceptions about climate change, and information. With respect to the motivational context for adaptation, findings around some mediating factors provide empirical support for emerging frameworks that consider the more amorphous, intangible dimensions of adaptive capacity, through use of indicators such as perceptions of risk and the factors that influence it, and attachment to place and occupation (Marshall et al., 2010; Grothmann and Patt, 2005; Kasperson and Kasperson, 1996).

With respect to attachment to occupation (Marshall et al., 2010), findings from this research have implications for consideration of diversification as a potential adaptation strategy. Findings indicate that respondents conceptualize the kind of diversification in which they currently engage separately from how they construct their self-identity, which is usually tied to one specific livelihood activity. This is thought of as a profession, and is about who somebody “is;” the various other activities undertaken to supplement income throughout the

year, on the other hand, are thought of as temporary, as what someone is "currently doing." This suggests that flexibility in terms of transitioning permanently into an entirely new livelihood involves challenging emotional and psychological processes alongside more practical requirements like acquiring new skills. It requires re-defining how someone self-identifies through their profession, which, in turn, is embedded in local institutions like family tradition, and norms about which kinds of activities are valued more than others in a given context.

Related to this, other local level institutions, such as gender norms about the kinds of work women can engage in, also affect flexibility in diversification of livelihoods, particularly for women and female-headed households. Intangible factors and processes such as these thus prove useful characteristics for exploring individual-level climate-related vulnerability, and highlight potential areas of support for building adaptive capacity among extremely poor rural communities. Planned adaptation strategies that involve support for transitioning into new, more climate resilient livelihoods, are more likely to be taken up by local communities if based on a knowledge of how the institutions and norms around attachment to occupation operate at the local level, and how they affect choices by different groups of people about what kinds of work to engage in.

Other frameworks for adaptive capacity also emerge as central in exploring the situation with respect to extremely poor communities. For example, CCCD (2009) identify human development and access to basic amenities as primary building blocks for adaptive capacity. These seem particularly relevant for extremely poor people, many of whom lack education and skills, access to healthcare and amenities like water and sanitation. Ensor (2011)'s emphasis on areas for support in the building of adaptive capacity, around power sharing, knowledge and information, and experimentation and testing, also emerge as particularly relevant for extremely poor people, particularly given the nature of livelihoods among extremely poor people, for instance lack of decision making power over the resources and activities upon which their livelihood security depend.

8.3.2. Implications for interventions to reduce vulnerability and build adaptive capacity among extremely poor communities

Much climate change literature is focused on 'the poor,' and many government and donor adaptation programmes emphasize interventions aimed at protecting and insuring against climate impacts on financial and productive resources. However different types of adaptation support may be required for extremely poor individuals, most of who lack secure access to the same kinds of resources, and who lack decision-making power with respect to the resources

on which their livelihoods depend.

In this context, findings suggest that for extremely poor people, interventions focused on assets may be less important than those directed at improving security, for example social protection, basic health, and education services. Conversely, the lack of these services is often a major determinant of vulnerability to climate (and other) shocks and stresses, and constrains the ability to cope effectively, and take advantage of opportunities, for instance, transitioning into less climate-sensitive livelihood activities. This means that even in the absence of planned climate change adaptation interventions per se, there is a vulnerability reduction role for governments and development (Schipper, 2007) aiming to encourage largely autonomous activities where resources do not exist to engage in more intensive planned programmes. Ensuring social safety nets function, are timed according to need (i.e. responsive in the case where floods happen four to five times in a season instead of the expected two to three), and cracking down on corruption, to ensure flood relief distributions and other official safety nets reach intended beneficiaries, would be examples of activities that would fall into this category.

This research also highlights the importance of other non-climate areas of policy that are critical for adaptation, such as land distribution (especially finding and allocating land for people to move to), funding more locally relevant science (i.e. for river bank erosion solutions), and creating incentives and providing infrastructure for development of less climate-vulnerable economic activities. While there are many actions that can and must be taken at the community level in relation to adaptation, there is a central role for government and NGOs, and of interventions, policies, and processes that occur at other scales.

Emanating from the differentiation and commonalities in climate-related vulnerability among extremely poor respondents, adaptation interventions may also fall into two broad categories, with the *first layer* corresponding to an underlying, common set of needs relating to health, education, access to basic amenities. This reflects calls for a vulnerability reduction approach for development with respect to supporting climate change adaptation and building of adaptive capacity among poor people. These are critical to support flexibility in terms of the ability to access less climate sensitive income-earning opportunities in the local area, or move to more sustainable areas (especially relevant for *char* dwellers).

A *second layer* of adaptation interventions may be more tailored, or differentiated, responding to needs of specific livelihood activities and social groups vis-a-vis different climate impacts—for instance facilitating migration for agricultural day labourers to other districts for work before flood season begins, or support for women in carrying out household chores

during floods. The second layer would need to be based around the timing of weather patterns/climate extremes and be flexible enough to respond rapidly as these conditions change, and do so at an accelerating pace.

To the extent that comprehensive programs are not feasible due to lack of resources and institutional capacity, the first layer of interventions will probably be most important for extremely poor communities, coupled with a focus on some of the mediating factors discussed above, e.g. strengthening climate early warning and information based both on scientific and indigenous knowledge, building social and community networks, and discouraging political networks that tolerate corruption and reinforce exclusion of extremely poor people.

In designing poverty and livelihoods programmes for extremely poor communities in climate sensitive areas, a potential indicator for an 'adapted' community could be flexibility, or ability to change livelihood activity easily, in response to and in preparation for weather patterns and climatic hazards in the present, as well as more gradual climatic changes over the longer-term. A strategic focus on flexibility may well affect the approach to timescales and frequency of existing interventions (e.g. flood coping support four times during flood season rather than once or twice, and recognition of emerging needs that arise due to progressively shortening periods of time to recover between floods). An important difference between climate change adaptation and current poverty/livelihood/development strategies may be precisely in the timing, sequencing, and information on which activities are planned.

8.3.3. Reflections on the methodological approach and suggestions for future research

The methodological approach throughout all phases of fieldwork was qualitative, employing RRA techniques. It aimed to explore livelihoods, shocks and stresses, and coping and mediating factors, from the perspective of respondents. The frameworks (e.g. Livelihoods Framework; frameworks for adaptation, adaptive capacity, and vulnerability) and conceptual grounding for this thesis therefore informed selection of fieldwork methods but did not translate into data collection methods structured to cover only the topics highlighted by these frameworks. Instead the broad categories of livelihood resources, coping activities, and mediating factors were the only pre-defined foci for data collection set before entering the field; the factors and processes that populate these categories of data were provided by respondents.

The livelihoods approach provided a useful way to disaggregate vulnerability into sets of tangible and intangible resources. On the other hand, it does not highlight the processes of

change that lead to accumulation and loss of resource holdings. Therefore coupling livelihoods based interviewing with process and change-based methods can be particularly effective. Here, life history interviews (Davies, 2006, 2007), historical timelines, seasonal calendars, and questions relating to changes in access to resources and engagement in livelihood activities helped to capture vulnerability as a dynamic process rather than as a snapshot in time.

Findings illustrate the utility of taking a social vulnerability approach in terms of exploring differentiation across respondents, and between extremely poor and non-poor community members with respect to exposure, sensitivity, and coping. In particular, this approach helped to identify the non-climatic factors and drivers of change that influence both how impacts play out across groups of people, and response activities adopted. Participatory methods (i.e. CVCA, Chapter 3, Section 3.4.1) were used in order to elicit the views of the vulnerable (Tschakert, 2007) with respect to their perceptions of climate change, whether climate-related shocks represent a major source of risk for local people in the field site areas relative to other sources of risk, and how this affects coping and adaptation (Kasperson and Kasperson, 1996). These are critical first steps to designing the kinds of interventions that will meet the needs of local communities and be taken up.

However, as with any theoretical framework, limitations exist. In particular, because the theoretical approach and methodology that followed from this framing are focused primarily on understanding the local context through respondent perceptions and experiences, the approach does not necessarily yield data that may also be important in the formulation of different policy domains or prescriptions. For example, in this research, respondents were extremely wary about discussing local politics and their own political affiliations, given that they are extremely poor, tend to lack political voice, and were therefore concerned that speaking ill of locally powerful individuals, local government members, and so on, could potentially exclude them from receiving benefits, or worse, make them targets, such as through the bringing of false court cases. Therefore, supplemental analysis may be necessary, as well as a deep understanding of the local context of fieldwork in order to ensure sound linkages between reported perceptions and mediating factors, on the one hand, and policy interventions, on the other.

In terms of areas for future research, expansion of empirical work around the factors and processes that shape the experience of vulnerability on the ground and adaptive capacity for highly vulnerable albeit under-researched groups of people emerges as critical for taking forward the pro-poor climate change agenda. Exploring how areas of differentiation and

commonality in how people experience vulnerability and respond to shocks at the local level may translate into different areas of policy intervention is crucial. In particular, further empirical analysis is needed of intangible mediating factors, particularly those that influence the motivational context for adaptation. How these factors shape people's perceptions of risk, i.e. which risks people feel present the greatest challenges to their livelihoods, how they conceptualize and respond to these, and the factors that influences this context (Kasperson and Kasperson, 1996; Haddad, 2005; Grothmann and Patt, 2005) represent areas of research critical for community-level adaptation. In relation to local perceptions around climate change, particularly poverty impacts from specific climate-related shocks and stresses, combined research that elicits local perceptions and conducts a survey of pre- and post-shock resources against which to compare perceptions of change is another area of future research for vulnerability and adaptation at the local level.

8.4. Conclusions

This chapter summarizes the main findings of this research, drawing lessons and implications for research and the design of interventions for addressing climate change vulnerability and adaptive capacity among extremely poor people. The aim has been to contribute to the knowledge base for the development of pro-poor climate change adaptation perspectives by highlighting the fact that, while largely under-researched in the climate change field, the situation among extremely poor people on the ground with respect to climate change, is likely to be distinct to that of other socio-economic groups (e.g. poor farmers). Patterns of differentiation and commonality also emerge across extremely poor individuals and households in the field site areas, indicating the operation of mediating factors in shaping vulnerability to climate-related shocks and response. These findings indicate the role of various non climate-related factors and processes that may be particularly relevant in exploring the nature of vulnerability and adaptive capacity among extremely poor people.

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Appendix 1:
Climate Vulnerability and Capacity Analysis (CVCA) fieldwork methods

- **Transect walk**
  This was one of the initial methods that preceded participatory wealth-ranking exercises, and involved the process of walking around the village, led by one or more community members in order to observe the community, including land use patterns; community spaces and communal resources (e.g. schools, health facilities, community meeting areas); and any observable patterns of differentiation and commonality across households (e.g., quality of housing material, level of resources, proximity to the river, and other characteristics). The transect walk preceded the creation of a community/hazard map. In addition to providing data on the community, this method helped to build a rapport with community members, as it was the initial interaction with respondents (Chambers, 1997, Narayan et al., 1999).

- **Community/hazard mapping**[75]
  Following the transect walk, an FGD was carried out during which group members created a community map illustrating important communal resources (e.g. schools, roads, mosques, temples, health clinics), land use patterns, homestead areas, and parts of the village affected by different climate-related hazards, e.g. flood and erosion-prone areas. This exercise was useful for identifying hazards and risks as well as sensitivity of different community resources to these hazards, from the perspective of community members. The community map was verified by the group, and this was followed by discussion of the main hazards that affect the community (See Dazé et al., 2009: 33-34).

- **Vulnerability matrix**
  This exercise was employed to identify the hazards that most seriously affect important livelihood activities and assets, and to identify local coping strategies for addressing these. It began with identification by the group of their most important livelihood activities and the resources/assets that underpin these. Among these, the group then identified the five most important resources for livelihoods, which are listed on the vertical axis, on the left of the matrix. The main climate and non climate-related hazards that most seriously affect these resources/livelihoods were then identified and listed on the horizontal axis, across the top of the matrix. The same scoring system was used for each vulnerability matrix FGD, which involves rating the degree of impact from a given hazard using pluses, to illustrate high (+++), medium (++), and low (+) degrees of impact. Following completion of the matrix, each of the hazards was discussed in turn, including coping strategies employed to address impacts from each hazard on livelihoods. This included discussion of whether local strategies are effective, if levels of effectiveness have changed over time and why, as well as the role of government and NGO programmes (e.g. safety nets, food for work, flood relief), and factors that block and/or facilitate coping and adaptation for different groups of community members (i.e. poor, extreme poor, different livelihoods groups, men, women) (See Dazé et al., 2009: 39-40).

[75] See Maps 8 and 10, Chapter 5, for community maps of Rajiapur and Bariakari, respectively.

- **Seasonal calendar**[76]
  The aim of the seasonal calendar FGD was to create a calendar illustrating the seasons, activities, climatic conditions, and events of importance to the local community that occur within each season of the year. The activity began by asking group members to list all the seasons, and then include events like holidays/festivals, planting and harvest seasons, periods of food insecurity and migration, hazards and disasters such as flooding and river bank erosion, times of health stress, and so on. A calendar is drawn, in which key events and periods are listed down the left hand side, and months of the year across the top of the calendar, plotting the months during which each activity/period/event occurs. Following the creation of the seasonal calendar, the groups were prompted to discuss the events and activities identified, including perceptions of change in the timing of seasons (weather patterns, climate events) and in the events that corresponded to these (e.g. planting and harvesting periods, availability of work), over the last 10 years. This also included discussion of any perceived changes in the coping activities undertaken during different seasons to address effects of events like flooding (See Dazé et al., 2009: 35-36; IFRC, 1999).

- **Institutional mapping using Venn diagram**
  This exercise was used to identify the formal and informal institutions in the field sites. Institutional FGDs explored the relative importance of these institutions in the lives of community members; the role of any institutions that supported coping activities during periods of climate-related shock and stress; patterns of membership (e.g. men, women) and inclusion in different groups; and the ways in which community members benefited from or were harmed by the various groups and institutions. A large circle was drawn to represent the community, and a symbol was selected to represent each institution or group. FGD members placed the symbol for each institution/organization in the circle, with the size of each representing the relative importance of the institution to the lives of the community members. The distance the FGD members decided to place the symbol from the centre of the larger circle signified the degree of involvement community members have in controlling the operation of the various institutions (See Dazé et al., 2009: 41-42).

- **Historical timeline**
  This exercise was used to create a history of important events in the life of the community, focusing on, but not limited to, climate-related events in the past, the nature of change in frequency and intensity of climate events, and changes in the degree of impact from these on community resources and livelihoods through time. The historical timeline included events such as major hazards (e.g. floods of 1988 and 1998) and the effects of these, as well as major political events and changes through time, for instance in land use and tenure, crops grown in the area, food security, and local administration/organization (ibid 2009: 37-38). The historical timeline was drawn by FGD participants, and subsequently used as templates during life history interviews (described in more detail in Chapter 3, Section 3.4.3) (See Dazé et al., 2009: 37-38).

[76] See Figure 7, Section 5.4.1, Chapter 5.